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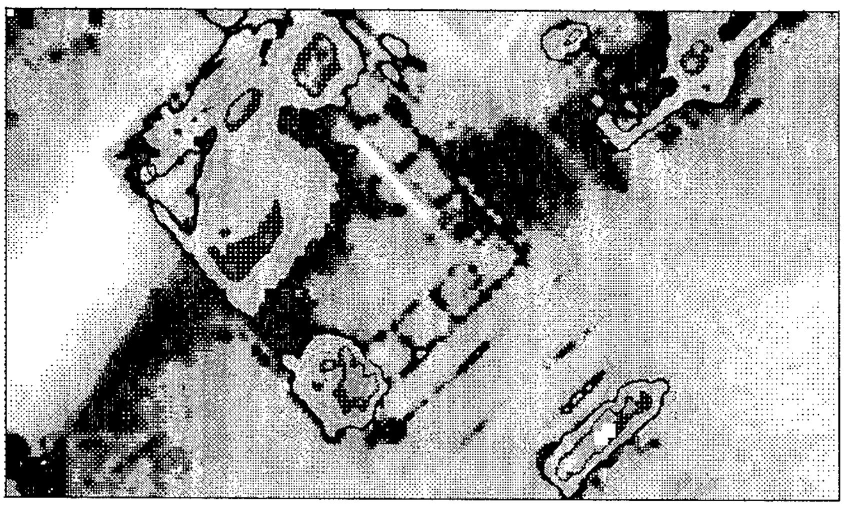
Geophysical and Archaeological Investigations of Historic Sites at Fort Riley, Kansas

Thomas K. Larson, Lewis E. Somers, Dori M. Penny, Michael L. Hargrave

Edited by Michael L. Hargrave



Resistivity Map Showing Subsurface Remains of Buildings at Army City

Federal statutes and Army Regulations require the Army to inventory archaeological sites to determine which sites are eligible for nomination to the National Register of Historic Places (NRHP). Geophysical surveys and archaeological excavations were conducted at six historic period sites at Fort Riley, Kansas. Project objectives were to evaluate the NRHP eligibility status of the sites and to assess the contributions of geophysics to that effort. A large-scale resistivity survey of the Army City site, a World War I era entertainment complex, was highly successful. The survey yielded a detailed map of subsurface remains of buildings, roads, and other features. Small-scale excavations verified many of the geophysical interpretations and provided substantial additional information about the nature and condition of the deposits. Resistivity surveys of five late 19th, early 20th century farmsteads also identified a number of geophysical features, but their interpretation was more difficult due to post-occupational disturbances. On balance, this project demonstrates that geophysics and carefully targeted ground-truthing excavations can contribute to the cost effectiveness and reliability of NRHP assessments of some sites.

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13. ABSTRACT ***(Maximum 200 words)***

Federal statutes and Army Regulations require the Army to inventory archaeological sites to determine which sites are eligible for nomination to the National Register of Historic Places (NRHP). Geophysical surveys and archaeological excavations were conducted at six historic period sites at Fort Riley, Kansas. Project objectives were to evaluate the NRHP eligibility status of the sites and to assess the contributions of geophysics to that effort. A large-scale resistivity survey of the Army City site, a World War I era entertainment complex, was highly successful. The survey yielded a detailed map of subsurface remains of buildings, roads, and other features. Small-scale excavations verified many of the geophysical interpre-tations and provided substantial additional information about the nature and condition of the deposits. Resistivity surveys of five late 19th, early 20th century farmsteads also identified a number of geophysical features, but their interpretation was more difficult due to post-occupational disturbances. On balance, this project demonstrates that geophysics and carefully targeted ground-truthing excavations can contribute to the cost effectiveness and reliability of NRHP assessments of some sites.

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Management Summary

This project represents one component of the U.S. Army Construction Engineering Research Laboratory's (CERL's) ongoing effort to develop a cost-effective and reliable strategy for assessing the National Register of Historic Places (NRHP) eligibility status of archaeological sites on Army and other Department of Defense (DoD) installations. The 12 million acres of land managed by the U.S. Army includes thousands of archaeological sites, many of which warrant a formal NRHP eligibility assessment. Under existing law and Army regulation, these sites must be protected until their NRHP status has been determined. Archaeological sites are widely scattered across the landscape, and avoiding them seriously constrains the realism that can be achieved in military training. The constraints on training are particularly severe at installations like Fort Riley, where large tracts of land are needed for mechanized vehicle training and live fire exercises.

The traditional strategy for NRHP site assessment is based on the hand excavation of very small portions of individual sites. Such assessments are expensive because they are labor intensive and produce collections of artifacts that must be analyzed and then curated under controlled conditions. Traditional site assessments can also be unreliable as a consequence of small sample sizes. Decisions about the NRHP status of archaeological sites are generally based on the excavation of less than one or two percent of the total site area.

In 1994 CERL initiated a program to evaluate the potential contributions of geophysics to archaeological site assessment. Geophysics includes a suite of noninvasive techniques (e.g., resistivity, magnetics, ground-penetrating radar) that can identify the location and, to varying degrees, the size, shape, and depth characteristics of subsurface phenomena. Geophysical techniques such as resistivity and magnetics can provide information about subsurface cultural deposits across large portions of a site, thereby increasing the reliability of site assessments. By targeting hand-excavated test units on those geophysical anomalies deemed most likely to correspond to intact cultural deposits, it should be possible to reduce the amount of excavation needed to assess a site's NRHP eligibility. An initial test of this approach conducted at Fort Riley in 1996 demonstrated that the use of geophysics and targeted ground-truthing excavations could reduce the costs and improve the reliability of site assessments, at least in some situations.

In 1997, geophysical surveys and archaeological investigations were conducted at six Fort Riley sites. Army City (14RY3193) represents a large World War I entertainment complex comprised of a number of commercial buildings, private residences, streets, sidewalks, and other facilities. Five late 19th, early 20th century farmsteads (14GE1108, 14RY152, 14RY2118, 14RY2170, and 14RY2171) were also investigated. One of the farmsteads (14GE1108) served as an alternate site, to be investigated only if archaeological excavations could not be conducted at one of the other farmstead sites. The geophysical survey of Army City was highly successful, providing a detailed, high resolution map showing the subsurface remains of the complex, particularly the commercial district. Limited test excavations recovered an artifact assemblage that is consistent with the age, functional character, and demolition of the site as known from period maps, photographs, and other historical records. As a privately owned commercial facility designed specifically to provide entertainment and other services to World War I soldiers, Army City is virtually unique. The Army City site is recommended as eligible for nomination to the NRHP under Criteria A and D.

Two farmsteads (14RY152 and 14RY2170) have been extensively disturbed by military training activities. The archaeological deposits lack depositional integrity and the sites are thus ineligible for the NRHP. In contrast, 14RY2118 is characterized by relatively early (ca. 1868) complex, and well-preserved deposits. Archaeological excavations indicate that the cultural deposits are thin but stratified, and the site has sustained little impact from military training. 14RY2118 is recommended as being eligible for nomination to the NRHP. Finally, insufficient investigation was conducted at site 14RY2171 to allow a satisfactory assessment of the site's NRHP eligibility status. It is recommended that additional archaeological investigations be conducted in the northern portion of the site.

Results of this project clearly demonstrate that geophysics, particularly resistivity, can reduce the costs and dramatically increase the information return of NRHP eligibility investigations of some site types. This is particularly true for very large historic sites (e.g., Army City) where architectural remains are likely to be present but are not visible on the surface. In such situations, geophysical maps will allow archaeological excavations to be targeted where they will produce the most useful information about depositional integrity and the patterning of past activities.

The role of geophysics in assessing historic farmsteads is more variable. Geophysics should be very useful in assessing farmsteads where the layout of architectural remains is not fully known based on surface indications, and where there has not been extensive vehicular disturbance. At present, it appears that

geophysics will contribute less to the investigation of highly disturbed sites and/or sites where most of the architectural remains are visible on the surface.

By conducting in-house resistivity surveys of sites and site areas within the cantonment, Fort Riley should be able to minimize costs associated with cultural resources investigations required by future infrastructure developments. Resistivity surveys of sites where buildings or other features are known to have been present (based on historic maps or photographs) will help Fort Riley document the validity of negative evidence.

Given the potential benefits of geophysics when used appropriately, it is recommended that Fort Riley continue its efforts to identify the optimal role of geophysical survey in archaeological site assessment.

Foreword

This study was conducted for the Directorate of Environment and Safety, Fort Riley, under Military Interdepartmental Purchase Request No. 9763450018, "Geophysical and Archaeological Investigations at Fort Riley." The technical monitor for this work was Dr. Richard Shields, AFZN-ES-C.

The work was performed by the Land and Heritage Conservation Branch (CN-C) of the Installations Division (CN), U.S. Army Construction Engineering Research Laboratory (CERL). The principal investigator was Michael L. Hargrave, who also edited the report. Robert Riggins is Chief, CN-C, and Dr. John T. Bandy is Chief, CN. Dr. Michael J. O'Connor is Director of CERL.

Fort Riley Cultural Resources Management (CRM) Administrator Dr. Richard Shields and Archaeologist John Dendy (Dynamac Corporation, Fort Riley) provided administrative guidance, technical input, historical information about Fort Riley, and logistical assistance to the CERL, Geoscan Research USA, and LTA, Inc. researchers. With the assistance of Scott Hall (ORISE) and Fiona Price (J.M. Waller Associates, Inc.), Dr. Shields and Mr. Dendy are now incorporating in-house resistivity surveys into Fort Riley's CRM program.

Dr. Lewis E. Somers (Geoscan Research USA) not only conducted the geophysical studies but also served tirelessly as a mentor to explain how geophysics should be integrated with archaeological fieldwork. Bill Chada and David Goldsmith assisted Dr. Somers with the geophysical surveys. Bob Thompson, Rebecca Whitehill, and James Wood provided additional help in the field. Mr. Chada assisted with the geophysical data processing and Cora Matheson assisted with report production.

Thomas K. Larson (LTA, Inc.) accomplished the archaeological investigations in a highly competent and cost-effective manner. He was assisted in the field by Michael Boley, Keith Dueholm, Scott Hall, Ross Hilman, and Heather Wright. Dori M. Penny assisted with the report preparation. Dori Penny and Ross Hilman conducted archival research.

At CERL, Suzanna Walaszek revised some of the figures in AutoCAD. The technical editor was Linda Wheatley, Information Technology Laboratory.

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by

Michael L. Hargrave

Background

Federal statutes and Army regulations (e.g., National Historic Preservation Act of 1966, as amended; Army Regulation [AR] 200-4) require the Army to inventory archaeological sites (and other historic properties), and to determine which sites are eligible for nomination to the National Register of Historic Places (NRHP). This requirement poses a major challenge for Army cultural resource managers. It has been estimated that the 12 million acres of land managed by the U.S. Army contain some 36,000 prehistoric and historic archaeological sites (Guldenzopf and Farley n.d.). Sites are widely dispersed across the landscape and the requirement to protect (i.e., avoid) them until their NRHP status has been determined represents a significant impediment to military training. Despite their wide use over the past three decades, traditional strategies for assessing the NRHP status of archaeological sites are expensive and unreliable. Since 1994, the U.S. Army Construction Engineering Research Laboratory (CERL) Cultural Resources Research Center has worked to develop a more cost effective and reliable strategy for NRHP site assessment based on the use of geophysical survey techniques and highly targeted ground truthing excavations (Hargrave 1998; Hargrave and Zeidler 1997; Zeidler 1998). An initial project conducted by CERL at Fort Riley during the summer of 1996 indicated that geophysics could increase the cost effectiveness and reliability of NRHP assessments, at least at some sites (Hargrave 1998). In December 1996 the Fort Riley Cultural Resources Management (CRM) Administrator Dr. Richard Shields and archaeologist John Dendy (Dynamac Corporation, Fort Riley) requested CERL's assistance in conducting NRHP eligibility assessments of a number of historic period archaeological sites.

Objectives

This document is the final report on CERL project K77, "Archaeological Investigations at Fort Riley." The report objectives are to (1) synthesize the geophysical

and archaeological investigations conducted at each site and (2) assess the contributions of the geophysical investigations in determining the NRHP status of the sites.

Approach

This project represented a field test of a strategy for assessing the NRHP status of historic sites using geophysics and ground-truthing excavations. Fort Riley requested that CERL continue its investigation into the role of geophysics in archaeological site assessment. Specifically, Fort Riley requested that CERL conduct geophysical surveys at the Army City complex (14RY3193) and five historic period farmsteads. These surveys were to be followed by a program of test excavations designed to assess each site's eligibility for nomination to the NRHP, and to evaluate the effectiveness of the geophysical surveys in identifying subsurface cultural deposits. Geophysical investigations of sites 14RY152, 14RY2118, 14RY2170, 14RY2171, 14RY3193, and 14GE1108 were conducted by Dr. Lewis Somers, Geoscan Research (USA) in May 1997. Archaeological investigations at these same sites were subsequently conducted by Thomas K. Larson, LTA, Inc., in June and July 1997.

This report consists of two main parts covering geophysical and archaeological investigations. Chapter 1 provides background information on the Army's CRM responsibilities and on traditional and geophysical approaches to NRHP eligibility assessments. A report (Somers 1998) on the geophysical investigations at the aforementioned sites comprises the remainder of the first part. The second part of the report consists primarily of a report (Larson and Penny 1998) on the archaeological investigations. The Somers (1998) and Larson and Penny (1998) reports have been modified slightly for inclusion here. Chapter 6 synthesizes the results of the two investigations, discusses a number of methodological issues in the use of geophysics in site assessment, and offers recommendations for future use of geophysics in Fort Riley's CRM program.

National Register of Historic Places Eligibility Criteria

As the stewards of extensive tracts of public land, Department of Defense (DoD) installations have a responsibility to manage a wide array of cultural resources, including historic and prehistoric archaeological sites. Key legislation defining the historic preservation responsibilities of Federal Agencies includes the National Historic Preservation Act (NHPA) of 1966, as amended, the Archaeological Resources Protection Act of 1979, the Native American Graves Protection and

Repatriation Act of 1990, and Executive Order (EO) 11593. AR 200-4 specifies Army policies, procedures, and responsibilities for meeting CRM requirements.

The NRHP plays a central role in the Federal Government's CRM program. Authorized by NHPA, the NRHP is a listing of districts, sites, buildings, structures, and objects that played a significant role in American history, architecture, archaeology, engineering, and culture. Before the execution of a Federally funded, assisted, or licensed undertaking, the sponsoring agency is required to make a reasonable and good faith effort to identify historic properties on or eligible for the NRHP that may be adversely affected by the undertaking.

Efforts to identify archaeological sites are typically divided into several phases or stages, including an inspection of maps and records, and an on-site survey of the proposed project area. Sites must then be assessed as to their potential eligibility for nomination to the NRHP. In many cases, a low density of artifacts, the absence of evidence for intact cultural strata, and/or the extent of previous adverse impacts clearly indicate that a site is not a viable candidate for the NRHP. In other cases, however, it is necessary to conduct additional investigations to determine if a site is eligible. These NRHP site eligibility assessments generally involve a program of test excavations.

Eligibility Criteria

To be eligible for the NRHP, an archaeological site must be significant. It must also possess integrity.

Significance

To be significant, a site must meet at least one of four criteria:

1. Criterion A requires that a site be associated with events that have made a contribution to the broad patterns of U.S. history.

2. Sites that are associated with the lives of significant historical figures may qualify under Criterion B.

3. Criterion C pertains to those sites that embody the distinctive characteristics of a type, period, or method of construction, and that represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity (USDI 1995).

4. Criterion D requires that the site have the potential to yield important information about human history or prehistory.

Archaeological sites are most commonly eligible for the NRHP under Criterion D. Many sites can provide at least some information about history or prehistory. The importance of the information a site may yield must be assessed using an appropriate historic context. A historic context is a compendium of data and interpretations, organized by one or more themes (e.g., by time period, region, etc.). A site that cannot be related to a particular time period or culture-historical unit will not have a historic context and so cannot be eligible for the NRHP. Important information will, for example, allow researchers to better understand gaps in existing knowledge, propose theories and test hypotheses that support or challenge conventional understandings, and so forth (USDI 1995:21–22). It is important to note that a site need not be nationally significant to be eligible for the NRHP. Properties that are significant at a local, state, or regional level are also eligible. Also, individual properties can be relevant to more than one historic context. For example, a building erected during the earliest period of a military installation's history could also be relevant to one or more subsequent periods.

Once it has been determined that a site may be able to produce important information, it is necessary to develop a research design. The research design will identify particular, well-defined research questions, and will specify the type of data from the site that can be used to address those questions. The research design thus provides a basis for selecting the appropriate mix of investigative techniques to be used in the eligibility assessment. The objective of the eligibility assessment is to document that the information needed to address the specified research questions is present at the site.

Integrity

To be eligible for the NRHP, a site must also possess integrity. Integrity is the condition or state of preservation or intactness that allows a site to convey its significance. For a site that is eligible under Criterion D to have integrity, it must be sufficiently intact as to be able to yield the expected important information, assuming that the appropriate recovery techniques are used. "For properties eligible under Criterion D, integrity is based upon the property's potential to yield specific data that addresses important research questions, such as those identified in the historic context documentation in the Statewide Comprehensive Preservation Plan or in the research design for projects meeting the Secretary of the Interior's Standards for Archeological Documentation" (USDI 1995:46).

Traditional Strategies for Assessing NRHP Eligibility

The NRHP eligibility guidelines recognize several aspects of integrity, including integrity of location, design, setting, materials, workmanship, feeling, and association (USDI 1995:49). An adequate evaluation of integrity requires a consideration of a property's physical features and how they convey its significance. In practice, many archaeologists view the presence of intact cultural deposits as the minimal requirement for integrity of an archaeological site. Such deposits typically provide the contextual and chronological information needed to address a variety of research questions about settlement, subsistence, and other practices. Sites that represent very rare resource categories are sometimes viewed as eligible even if no intact deposits are present. For example, a lithic scatter comprised primarily of artifacts thought to date to the Paleoindian period may be viewed as eligible even if the site is restricted to the plow zone. Here there may be no intact cultural strata; nevertheless, there could be integrity of association among a set of functional (tool and debris) types distinctive of and informative about a particular time period. In most cases, however, archaeological sites must have intact horizontally extensive cultural strata (commonly, if imprecisely, referred to as midden) or discrete (horizontally restricted) features such as pits, postholes, or other architectural remains in order to be viewed as eligible for the NRHP. Simply demonstrating that such deposits are present does not represent an adequate argument for a site's eligibility. A site's relevance to important research questions must be demonstrated, not simply assumed. In terms of site assessment field strategy, however, the focus is on identifying intact cultural strata and features.

NRHP assessments commonly include the use of several field techniques, including controlled surface collections (if surface visibility permits), the excavation of small shovel, posthole, or auger tests, and the hand excavation of a small number of test units. A few states (e.g., Illinois) require or strongly encourage the use of heavy equipment to remove the plow zone or topsoil in order to investigate a larger percentage of the total site area. In Kansas, the State Historic Preservation Office (SHPO) has disseminated written recommendations about the techniques that can and, in some cases, should be used in NRHP assessments of archaeological sites (Brown and Simmons 1987). The Kansas SHPO guidelines note that "resistivity surveys, magnetometry, and ground-penetrating radar may be very useful to delineate features that are not observable from the ground." It is also noted that "[t]he generating of maps, showing low and high values, offers an alternative approach to excavation and can provide valuable information regarding the significance of a site" (Brown and Simmons 1987:8–10). In recent years, several projects in Kansas have included the use of geophysical techniques (Hargrave 1998). However, most NRHP assessments

cal techniques (Hargrave 1998). However, most NRHP assessments conducted in Kansas, as in other states, rely exclusively on the use of traditional techniques.

Limitations of Traditional Assessment Strategies

Traditional NRHP eligibility assessment strategies based on hand excavation commonly have two major limitations: they are unreliable and expensive. It is common for NRHP assessments to involve the excavation of, at most, 1 percent of a site. The degree to which small sample size compromises the reliability of a site assessment depends largely on the nature of the cultural deposits present at the site. Some sites are characterized by the presence of a horizontally extensive midden or other intact (sub-plow zone) cultural strata. Horizontally extensive deposits may be identified even if the site assessment program involves nothing more than the excavation of several widely spaced test units. At many sites, however, all past living surfaces have long since been incorporated into the modern plow zone. But some of these sites include discrete subsurface features such as hearths, storage pits, privies, cisterns, and architectural remains. The upper portions of these features have, in many cases, been truncated by modern agricultural activities, but the lower portions often remain intact. Unfortunately, the laws of probability suggest that it is highly unlikely that any of these discrete features will be encountered by a small number of widely spaced test units, or even by a grid of evenly spaced shovel tests. For sites characterized by discrete features but no horizontally extensive cultural strata, the traditional site assessment strategy is highly unreliable.

Traditional site assessments are expensive because they are labor intensive. Costs vary widely as a result of local and regional differences in labor rates (as codified in the Service Contract Act rates for Federally funded projects), the nature and amount of work required, the complexity of particular archaeological sites, the amount of competition among contractors, etc. A recent study conducted by CERL compared the costs and benefits associated with traditional and geophysical approaches to NRHP assessments (Hargrave 1998). Based on a sample of 25 sites investigated in Kansas since 1990, NRHP assessment has involved the hand excavation of test units exposing an average of about 6 m^2 and about 20 shovel tests (the number of shovel tests excavated was highly variable and inconsistently reported). Project costs averaged just over $8,000 per site. In that study, no adjustments were made for the effects of inflation. It is clear, however, that the mean cost of recent site assessments is substantially greater than $8,000. For example, the mean cost for the traditional assessment of 13 sites investigated at Fort Riley in 1997 was $10,929 (Hargrave 1998).

A Geophysical Approach to NRHP Site Assessment

Geophysics is that branch of the earth sciences dealing with physical processes and phenomena in the earth. Geophysical techniques have been used by archaeologists for more than 50 years (Heimmer and De Vore 1995:1). A number of overviews of geophysical techniques relevant to archaeology are available (e.g., Clark 1990; David 1995; Ebert 1984; Gaffney et al. 1991; Heimmer and De Vore 1995; Weymouth 1986; and Wynn 1986), and no attempt will be made to reiterate these here.

Geophysics is much better integrated into archaeological research in Great Britain and Europe than in North America. In the Old World, many archaeological sites include substantial architectural remains and abundant metal artifacts. These materials were relatively easily detectable by early geophysical instruments, and this contributed to the early acceptance of geophysics by Old World archaeologists. In contrast, North American sites tend to be much more ephemeral. Prehistoric architectural remains and other features are generally manifested in the archaeological record by relatively subtle differences in soil color and texture. Stone architecture does not occur in many regions, and metal artifacts are, for all practical purposes, absent at prehistoric sites. The low contrast between cultural deposits and the surrounding matrix results in a relatively weak response to geophysical survey methods. Also contributing to the weak response is the relatively small size of the cultural features (pits, postholes, and hearths) characteristic of most North American prehistoric sites. At historic sites, the contrast may be much greater and architectural features tend to be much larger. Thus, survey design for historic sites is less critical than for prehistoric sites (Somers 1998).

For archaeological applications, the most versatile and cost-effective geophysical techniques include resistance and magnetics. Ground penetrating radar (GPR) can be very effective in some situations, although instrument costs are relatively great and surveys can be relatively time consuming if site conditions are not ideal.

The resistivity method is the most widely used of the electrical geophysical methods. Over the past 20 years, most archaeological applications of the resistivity method have used the twin probe or twin electrode array (Gaffney et al. 1991:2). Twin electrode resistance equipment, in contrast to electromagnetic instruments, does not respond to buried pipes or other metal, does not generate a background signal dependent upon the height of the instrument above the surface, and the depth of the survey is easily adjusted in the field. Current instruments (such as the Geoscan Research RM-15) offer automated logging of both

data and data sample location and the ability to process and display data on portable computers in the field. Thus, the surveyors have access to high quality maps at the site during the survey (Somers 1998).

The resistivity method has several potential disadvantages. First, the method is not suitable for surveying soil that is water saturated. Next, use of a resistivity instrument involves insertion of probes into the ground at each point where data are collected, with the result that the rate at which an area can be surveyed is slower than that achieved in magnetic (e.g., gradiometer) surveys. Also, like the other geophysical techniques, resistivity may not detect very small or low-contrast targets.

Magnetic survey methods are based upon localized disruptions in the earth's magnetic field. Magnetic techniques can identify archaeological features and artifacts, which are magnetically differentiated from the surrounding matrix. Proton magnetometers have been used in archaeological studies since the 1950s. Proton-precession and fluxgate (gradiometer) magnetometers are now in wide use. A gradiometer has two magnetic sensors or magnetometers separated by a fixed distance (0.5 m). Whereas a survey using a single magnetometer is likely to be corrupted by modern iron trash, a gradiometer is less severely compromised by modern iron objects as well as the effects of diurnal variations, magnetic storms, power lines, and regional gradients (Geoscan Research 1993). Instruments such as the Geoscan Research FM-36 offer automated data logging and fully integrated software, thus providing convenient data collection, processing, and display on portable computers in the field (Somers 1998). Magnetic instruments, particularly gradiometers, allow relatively rapid survey coverage per unit area (Clark 1990:78).

An inverse relationship exists between depth and sensitivity in a magnetic survey. Clark (1990:78–79) describes this relationship (using an example from Great Britain) as follows: "for a total field instrument such as a single sensor proton magnetometer...and a 0.5 meter (1.6 ft) fluxgate gradiometer...there is a rapid fall-off in sensitivity...between 1 and 2 m...and by 3 m (10 ft) the limit of detection is effectively reached for most features" (1990:78). At that depth, the anomalies associated with a typical pit or kiln feature could not be detected against the background data values. Conversely, sensitivity increases substantially at depths less than 1 m.

An inverse relationship also exists between the horizontal distance between data reading points and the image resolution that can be achieved. Clark (1990:81) notes that "...a reading interval of 0.5 m (1.6 ft) is the largest suitable for detailed recording, and there is a further gain in resolution at 0.25 m (10 in), four

readings per metre. Going to 0.125 m (5 in), eight readings per metre, produces only a marginal improvement on this."

Ground-penetrating radar instruments include an antenna that contacts the ground surface and sends and receives a high frequency electromagnetic signal into the earth (Conyers and Goodman 1997). The reflected signal is then compared to the original input. The manner in which the signal is reflected or attenuated, as well as its magnitude or amplitude, phase (negative or positive), and frequency provides information about the nature of the subsurface materials. Radar can provide cross sectional maps that are informative about soil strata, bedrock, buried objects, and cavities or voids (including cultural features). Current radar instruments and supporting software allow the operator to view survey results on a computer screen as the survey is underway.

Archaeological applications of GPR are presently characterized by several limitations (Heimmer and De Vore 1995:42; David 1995:25). GPR systems are relatively expensive, and the interpretation of survey results requires specialized software and considerable expertise. Site conditions such as saturated soils or highly conductive clay soils can dramatically restrict the depth of penetration that can be achieved. An uneven ground surface can complicate data interpretation. Similarly, reflected signals passing through the air (from incompletely shielded antennas) can obscure signals from subsurface phenomena. Furthermore, "on archaeological sites the distribution of material of differing electrical properties is often complex and can make the radar data confused" (David 1995:27). As with resistivity and magnetic techniques, the resolution obtainable using GPR is inversely related to survey depth.

2 Geophysical Investigations: Background, Survey Design, and Methods

by

Lewis E. Somers

Introduction

Geophysical investigations were carried out at Fort Riley, Kansas, during May 1997. The work was performed by Dr. Lewis Somers, Geoscan Research (USA). Chapters 2 and 3 are derived from the final report submitted to CERL by Somers (1998).

All six of the sites investigated during this project date to the historic period. (More detailed background information about each site is presented in Chapter 4 of this report). Five of the sites (14GE1108, 14RY152, 14RY2118, 14RY2170, and 14RY2171) represent historic farmsteads. The sixth site, Army City (14RY3193), was a civilian-owned complex that provided entertainment and other services to troops stationed at Fort Riley during World War I. Located just east of Camp Funston, Army City was a complex of buildings, roads, and empty lots that covered an area of approximately 400 x 400 m. Some of the complex was destroyed by fire and the remaining buildings were dismantled or moved (to Ogden) in the mid-1920's. The site now occupies a grassy field with little or no discernible evidence of the buildings and roads present there 75 years ago. A relatively small-scale geophysical survey was conducted in the eastern portion of Army City in 1996 (Somers 1997; Hargrave 1998). The 1997 work (reported here) represents a much more extensive survey of the site.

Survey Methods

For the purpose of this investigation, two geophysical survey methods were chosen: resistivity and magnetic. The following sections provide some background on how the methods work, as well as issues related to data collection, processing, interpretation, and display.

Resistivity

Resistivity surveys introduce an electrical current into the ground and measure the ease (or difficulty) with which this current flows through the soil. Resistivity values for a given locus are influenced by a combination of soil moisture, soluble ion concentration, and soil type. Moist soils have lower resistivity than dry soils. Fine soils (clay) have lower resistivity than coarse soils (sands or gravels), and soils with high salinity have low resistivity.

Archaeologically useful surveys result when the resistivity contrast between the archaeological record and the background soil matrix is great enough to be detected. Specifically, by virtue of the instrument probe geometry used in this survey method, the recorded data are average values made up of contributions from the background soil matrix and the archaeological record. To be detected and mapped, the contribution from the archaeological record must be greater than the statistical uncertainty associated with the sensing instrumentation, survey field methods, and background soil matrix.

A stone footing or foundation will usually appear in a resistivity survey map as an area of higher resistivity because the stones' contribution to the recorded average value is greater than that of the corresponding background soil matrix. This higher resistivity may be due to better drainage of water in the region of the foundation, the higher resistivity of the stone, or increased evaporation rates at the surface near the foundation. The converse can also happen. The foundation may not drain as well as the surrounding soil matrix and appear as a lower resistivity feature. Thus, a given archaeological feature may be manifested in a resistivity map as a local increase or decrease in resistivity. On occasion a neutral response can result from competing processes, and the archaeological feature may not be detected and mapped.

Resistivity survey data also contain contributions from the background soil matrix. These data can usually be distinguished from the archaeological record by their scale and geometry.

Magnetic Field Gradient

Magnetic methods are based upon localized disruptions in the earth's magnetic field. In a completely uniform magnetic field, the magnetic field gradient is zero everywhere. Archaeo-magnetic field gradient surveys can be thought of as mapping deviations from uniformity of the earth's magnetic field, which are caused by the presence of an archaeological record. The earth's field changes continuously with time and the change is usually greater than the archaeological distor-

tion. This change must be removed from the survey data to reveal the underlying archaeological components. Therefore, all archaeo-magnetic surveys must be performed with two magnetic sensors (magnetometers). One magnetometer is used to record the time variable component and the other records the spatial site data plus the time variable component. The time variable component is removed from the data by subtraction. In these surveys the more magnetically pronounced the archaeological record, the greater the field distortion and the greater the feature contrast in the survey map.

The archaeological record has two basic properties or mechanisms by which it distorts the earth's magnetic field. These properties are called remnant magnetization (a permanent magnetic field) and magnetic susceptibility (a bulk magnetic property similar to density). Both mechanisms alter the magnetic field at the surface of the site and thus are mapped as distortions of the earth's magnetic field.

Remanent magnetization is the familiar "permanent magnet" effect and is associated with iron and steel objects (including rust), ceramics, hearths, fire pits and some fire altered rocks and soils. In these materials, the remanent magnetization originates from heating the iron oxides (found in most but not all soils) above a critical temperature (565 to 675 °C). When the soil cools, the temperature induced changes in the iron oxide crystals are "frozen" and become permanent. It is this change in the magnetic state of the soil (ceramic, hearth, etc.) that generates a remanent magnetic field. This thermally created magnetic field adds vectorially to the earth's magnetic field to cause a local distortion. Thus, most cultural objects and processes associated with heating are potential archaeo-magnetic survey objects of interest.

The magnetic susceptibility alters the earth's magnetic field directly in a manner roughly analogous to the way porosity alters the flow of water through a solid. That is, where the magnetic susceptibility is large (high porosity) the magnetic field is increased and where the magnetic susceptibility is low (low porosity) the magnetic field is decreased. Many cultural objects and processes (thermal, biochemical, physical, and mechanical) locally increase the magnetic susceptibility of the native soil. The mechanism for this increase is also associated with changes in the iron oxide crystal structures within the soils. Local changes in site magnetic susceptibility alter the earth's magnetic field, and it is this distortion which is mapped. In magnetic surveys, remanent magnetization effects are usually somewhat greater than susceptibility effects.

Survey Design and Field Methods

All resistivity and magnetic surveys were performed in 20x20-m grids established at each site by LTA, Inc. Within the grids, horizontal control was implemented by means of nylon ropes marked at 1-m intervals combined with the automated data logging features in the survey instruments. Each grid data set is referenced to the south edge and the southwest corner of the 20x20-m grid unit. By using this standard and preserving the grid corner locations, it is possible to relocate a map feature in the field to within a fraction of a meter.

Resistivity Survey Design and Methods

The resistivity surveys were performed with an RM-15 Resistivity Meter combined with a PA-5 probe array. Both pieces of equipment are manufactured by Geoscan Research (UK), a small British firm specializing in geophysical instruments optimized for archaeological application. The instrument was operated in the twin-electrode mode. Data were collected every meter along a north-south traverse. The traverses were 1 m apart in the east-west direction. The recorded data consisted of (1) the resistance value, (2) the grid number, (3) the traverse line number, and (4) the line position.

The instrument electrode spacing was set at 0.75 m for all farmsteads and most of Army City. This setting provided a survey with primary response between 20 and 100 cm depth. The RM-15 resistivity meter was operated at 40 V output, 1 ma current, 137 Hz, in the mid-integration mode to ensure uncertainty in data value of less than 1:1000. This level of uncertainty was required to detect low-contrast archaeological features. This level of performance was validated at the start and end of each survey day. Data quality was assured by proper configuration of the RM-15 combined with data monitoring during the survey and individual grid data histogram post-survey monitoring. Parts of Army City were also surveyed with an electrode spacing of 0.5 m and 1.0 m.

Magnetic Survey Design and Methods

The magnetic surveys were performed with an FM-36 Magnetic Gradiometer, also manufactured by Geoscan Research (UK). This instrument contains two magnetometers separated vertically by 0.5 m. In operation, this instrument records: (1) the magnetic field distortion as the difference in the data from the two magnetometers, (2) the grid number, (3) the traverse line number, and (4) the line position. By recording the data difference between the two magnetometers, this instrument also removes the time variable components associated with the earth's magnetic field.

The survey grids were scanned with the FM-36 in a raster format. The survey proceeded from south to north along a traverse, followed by a second scan along the adjacent traverse (0.5 or 1 m east of the first) from north to south. This sequence was repeated until the entire grid had been surveyed.

The magnetic field gradient surveys were performed at 8 and 16 data samples per square meter. The sample density was adjusted to reflect the anticipated or known archaeology and background geology. The measured magnetic field gradient was sampled 3200 or 6400 times in each 20x20-m grid. The FM-36 Magnetic Gradiometer operated on the 0.1 nT sensitivity range.

Farmstead Surveys: Data Processing, Display, and Interpretation

Data Processing

All farmstead resistivity data were processed using Geoplot 2.1 software that is provided by the manufacturer of the survey instruments. The data quality was excellent and very little "clean up" processing was required. All resistivity data were highpass filtered to remove contributions associated with the background soil matrix. This filtering process enhanced the visibility of small, low contrast features.

Highpass filtering is implemented by subtracting the local data mean from each data point. Computationally, this is a convolution highpass filter and is implemented by calculating the local mean in a moving window that scans the entire map. The size of this window is adjustable but is typically set at a 5- to 10-m radius. The result is a new map in which the average "background" resistivity of the site has been subtracted. The mean value of the new map is zero.

Highpass filtering of resistivity data offers a number of benefits to the interpretation of archaeological data. In addition to enhancing the visibility of small low-contrast features, it also creates a resistivity map with zero mean. This zero mean map can be thought of as a resistivity map containing features that are greater than the local average (positive values) and features that are less than the local average resistivity (negative values). The zero data regions in the filtered map correspond to areas of no deviation from "background."

With this insight, it is convenient to interpret all positive data as features with "greater than average resistivity" (e.g., stone architecture, sand/gravel-filled pits, etc). In a like manner, it is convenient to interpret all negative data as features

with "less than average resistivity" (e.g., high-moisture backfilled pits and trenches, clays, and high salinity soils).

Data Display

The principal data presentation format is a series of gray-scale or halftone maps. These maps are similar in appearance to aerial images, with the survey data values being represented by gray levels. The halftone maps range from white (maximum negative data value) to black (maximum positive value). Mid-gray (i.e., 50 percent between black and white) is associated with the zero data value. This data display format is convenient and intuitive for both the magnetic field gradient data and the highpass filtered resistivity data since both are zero mean data sets. Non-highpass filtered farmstead data are also presented in filled contour format at sites where it aids understanding.

Data Interpretation

All survey data from the farmstead sites have been highpass filtered. On the survey maps, all resistivity features with data values greater than the background are mid-gray to black. In other words, the proper geophysical interpretation of these features is that their resistivity is greater than the local average background resistivity. Conversely, all resistivity features with values less than the background are displayed as light gray to white. The proper geophysical interpretation of these features is that their resistivity is less than the local average background resistivity.

The construction materials, construction methods, and geomorphology at the farmstead sites are sufficiently uniform that the following generalizations are useful for interpreting the highpass-filtered resistivity data maps:

1. Small-area positive resistivity features will have their origin in cement, loosely packed rock and stone, gravels, sands (if present), and pits filled with unconsolidated backfill.

2. Small-area negative resistivity features will be moist areas or pits backfilled with clay and organic/clay-rich material.

3. Large-area negative resistivity features, if not recognizable as cultural by virtue of their geometry, are probably clay lens or intrusions.

4. Large-area positive resistivity features, if not recognizable as cultural by virtue of their geometry, are probably bedrock outcroppings or sand/gravel lens.

Army City Survey: Data Processing, Display, and Interpretation

Data Processing

The Army City data (like the farmstead data) were processed using Geoplot 2.1 software. The data quality was excellent and very little "clean up" processing was required. All resistivity data have been nonlinear highpass filtered to remove variations in the background geology and thus enhance the visibility of small low-contrast features.

The Army City data presented a severe processing and display problem. For practical reasons having to do with field methods, instrument design, and temporal changes in background resistivity over the time of a multi-week survey, it was desirable to highpass filter the resistivity data and remove the variations in background resistivity (described above). When linear highpass filters are used for this purpose, however, a significant defect can be introduced. This processing-induced defect has the nature of a halo that surrounds large high contrast features. In the case of several large buildings present at Army City (e.g., the Hippodrome and the Orpheum), the halo defects associated with linear highpass filters obscure adjacent low-contrast features. Nonlinear highpass filters offer one solution to this problem and have been used to process Army City data.

Nonlinear highpass filtering is implemented by subtracting a local data average from each data point. This local data average is calculated based on a threshold that excludes unwanted large high-contrast values. Subsequent to filtering, the high-contrast values are replaced with a suitable bias. The result is a new map in which the average "background" resistivity of the site has been subtracted without introducing a halo defect.

Survey Data Display

The nonlinear highpass-filtered data are displayed in a hybrid format. The small data values associated with low-contrast (typically less than two standard deviations) features are displayed in the usual gray-scale format. The high contrast resistivity features are displayed in contour format superimposed on the gray-scale image.

Data Interpretation

In interpreting the Army City data, it is appropriate to use the same generalizations as were specified above for the farmstead data.

Test Unit Placement

The Statement of Work (SOW) for this project requested the geophysicist to provide specific recommendations as to the locations of test units designed to ground truth (investigate by means of excavation) the subsurface phenomena associated with resistivity and magnetic features. Specific recommendations for unit placement at each site are provided in Chapter 3 tables under columns titled "Trench." Several general principles underlie these recommendations.

At historic sites, test units are often positioned to intersect the edges of archaeological features. When edge features (transitions between low- and high-resistivity) are of concern, a linear trench perpendicular to the feature is recommended. The test trench should be placed perpendicular to the edge and overlap into the low- and high-resistivity areas a distance approximately equal to the twin-electrode separation distance (0.75 m in this survey). This kind of placement will allow a test trench to sample a minimal yet meaningful portion of the interior and exterior as well as the transition region. Trenches positioned in this manner should provide data useful for assessing the nature, integrity, and significance of a site.

Excavation to a depth of approximately three times the twin-electrode spacing or to the sterile horizon will reveal the subsurface phenomena contributing to the measured resistivity values. On occasion, resistivity features may not be visually observed in a test trench. For example, a high-salinity moist soil may be visually identical to a low-salinity moist soil but the measured resistivity could easily differ by a factor of 1,000. On these occasions careful attention must be paid to local variations in soluble ion concentration, physical soils particle size, and moisture variations.

It useful to examine the geophysical survey maps with a 1 x 1 m grid overlay. The area being examined should be displayed at a scale of approximately 1:200. Using this grid and scale, the archaeological features in the gray-scale maps can be conveniently and accurately located to within a fraction of a meter. Test units or trenches can be positioned on the map to +/- 25 cm and transferred to the field with similar accuracy.

3 Results of Geophysical Surveys

by

Lewis E. Somers

Farmstead 14GE1108

Site Description

Site 14GE1108 is a historic farmstead situated on a southeast facing slope (Figure 1*). The vegetation consists mostly of grasses with an occasional tree. The soils appear to be relatively shallow — less than 1.5-m depth. The underlying bedrock is probably limestone.

The site was surveyed with a twin-electrode resistivity configuration, an electrode separation of 0.75 m, and a data sample density of 1x1 per meter (Figure 2). This configuration provides soil resistivity information in the range of 20 to 100 cm depth. Large high-contrast features at depths greater than 100 cm will also be present in these data.

A detailed magnetic survey was not performed. A cursory magnetic survey throughout the areas of interest indicated a high density of very strong magnetic features. These features almost certainly represent historic iron objects which, by virtue of their strength, obscure the more subtle features (associated with intrusive stone, pits, and disturbed soils) in the archaeological record.

Survey Results

The 14GE1108 survey map displays a number of high-resistivity features that appear adjacent to, or associated with, architectural elements in the surface map (Figure 2, Tables 1–3). Features F, G, H, and I all contain localized high-resistivity components that are 1 to 2 m in dimension. Note that these localized

* Figures are placed at the end of the report.

high-resistivity features also run parallel to the topography contour lines, suggesting a terraced area or bedrock outcropping. Bedrock structures oriented northeast-southwest can also be seen in Figure 2 map as linear dark-shaded features.

Table 1. Description of geophysical features at Site 14GE1108.

Feature	N	E	Geophysical Description
A	98	64	large region of low resistivity
B	58	63	low-resistivity feature
C	49	63	low-resistivity feature
D	78	89	low-resistivity area
E	77	73	low-resistivity area
F	49	71	high-resistivity feature with internal structure
G	54	83	high-resistivity feature with internal structure
H	62	89	cluster, three localized high-resistivity features
I	71	85	high-resistivity feature with internal structure

Table 2. Cultural interpretation of geophysical features at Site 14GE1108.

Feature	N	E	Trench	Cultural Interpretation
A	98	64	98/64	unknown
B	58	63	58/63	unknown
C	49	63	49/63	unknown
D	81	89	81/89	unknown
E	77	73	77/73	unknown
F	49	71	49/71	possible architectural element
G	62	89	62/89	possible architectural element
I	71	95	71/95	possible architectural element

Table 3. Summary of survey results at Site 14GE1108.

Feature	N	E	Potential Preservation	NRHP Relevance	Priority	Comments
A	98	64	unknown	unknown	4	significant low resistivity at map edge
B	58	63	unknown	unknown	4	none
C	49	63	unknown	unknown	4	none
D	81	89	unknown	unknown	4	none
E	77	73	unknown	unknown	3	none
F	49	71	unknown	yes	2	possible well, slab, or rubble from adjacent surface feature
G	54	83	high	yes	2	possible well, slab, or rubble from adjacent surface feature
H	62	89	unknown	yes	3	none
	71	95	high	yes	2	possible well, slab, or rubble from adjacent surface feature

Note: 1 = Highest Priority, 4 = Lowest Priority

A few low-resistivity features have no obvious cultural association. Features D and E are both so localized and high contrast that they may be cultural. Features F, G, H, and I each contain individual clusters of localized high resistivity. In all probability, these clusters contain stone, cement, or loosely packed stone/gravel/soils.

Feature Testing

High-resistivity features F, G, H, and I appear to be reasonably well preserved (Figure 2). When examined in detail, each has very localized clusters of high resistivity. If anything in the 14GE1108 resistivity data is indicative of subsurface stone, cement, or rubble-fill features with structural integrity, it is F, G, H, and I. If found to be associated with cultural material on the surface, these features should be tested.

Low-resistivity features A, B, and C are probably geological. Low-resistivity features D and E, however, may be cultural. D and E are considered cultural candidates because they are very localized and high contrast (very low resistivity). Test trenches should be positioned following the guidelines presented in "Test Unit Placement" in Chapter 2.

Farmstead Site 14RY152

Site Description

This historic farmstead site is situated in a relatively level, brush and grass covered area overlooking an intermittent drainage. An open cellar is the most substantial architectural feature at the site. A stand of small trees near the cellar presented an obstacle for the geophysical surveys (Figure 3). There are indications of modern surface disturbance created by vehicular activity and military foxholes. The underlying bedrock is probably limestone.

The site was surveyed with a twin-electrode resistivity configuration, an electrode separation of 0.75 m, and a data sample density of one per meter in both the north-south and east-west directions. This configuration provided soil resistivity information in the range of 20 to 100 cm below surface. Large area high contrast features at depths greater that 100 cm were also expected to be present in these data. Figures 4 and 5 show the results of the resistivity survey.

A detailed magnetic survey was also performed using an FM-36 Magnetic Field Gradiometer operating at 16 data samples per square meter on the 0.1 nT

sensitivity range. The data sample density in the north-south direction was 8 samples per meter, whereas the sample density in the east-west direction was 2 samples per meter. This configuration can detect prehistoric hearths and historic soil disturbance to a depth of about 1 m in these soils. Buried iron objects appear as very high-contrast features in these data. Figure 6 presents the magnetic survey results.

Dense vegetation prevented survey data acquisition in the north-central portion of the site. These areas appear as the central white rectangular blocks in the maps (Figures 4–6).

Survey Results

Resistivity data from 14RY152 are shown in Figures 4 and 5. Figure 5 is a contour map of unfiltered field data. Figure 4 is a gray scale rendering of the same data after high-pass filtering. A number of high-resistivity features are identified in Figure 4 (and described in Tables 4–6). Those in the north-central portion of the site, designated as Feature K, are associated with the cellar. Features I, H, and J are possibly associated with some modest structures. Feature I, in particular because of its high contrast and spatial continuity, may be well preserved. The several high-resistivity features designated as feature J are also interesting and may represent a cluster of cement or stone objects. Several northeast-southwest oriented patterns (Features A, D, and F) could be the result of agricultural or military land use.

A number of magnetic features are present in Figure 6. Magnetic Features L, M, N, and O are distributed about the cellar and are probably historic iron objects. The individual iron objects designated as Feature O are spatially co-located with high-resistivity Feature I. This co-occurrence suggests that Features O and I warrant archaeological investigation.

Feature Testing

Features I and O warrant archaeological investigation because of their spatial coherence, high contrast, and the co-location of high resistivity and scattered iron. High-resistivity features in these soils imply the presence of stone, cement, and/or gravel, whereas the strong magnetic features imply historic iron. One possibility is that Features I and O represent a well. All black or white features shown in Figure 6 represent iron objects.

Table 4. Description of geophysical features at Site 14RY152.

Feature	N	E	Geophysical Description
A	16	42	transition high-resistivity/low-resistivity, linear
B	6	38	high-resistivity cluster with central maximum
C	6	51	3 significant high-resistivity features/rectangular pattern
C	3	56	3 significant high-resistivity features/rectangular pattern
C	7	62	3 significant high-resistivity features/rectangular pattern
D	9	78	triangular, high-resistivity map edge feature
E	22	77	large high-resistivity cluster
F	30	72	rectangular edge, high/low-resistivity transition with internal structure
G	36	75	high-resistivity feature
H	22	36	high-resistivity feature/cluster
I	25	22	localized significant high-resistivity feature
J	21	52	high-resistivity cluster
K	38	69	high-resistivity cluster
KK	28-38	53-60	high-resistivity area
L	40	54	a halo cluster of individual iron objects
M	56	40	large iron object
N	21	71	iron object
O	23	21	cluster of 3 iron objects
O	25	23	cluster of 3 iron objects
O	21	23.5	cluster of 3 iron objects

Table 5. Cultural interpretation of geophysical features at Site 14RY152.

Feature	N	EE	Trench	Cultural Interpretation
A	16	42	16/42	man-made
B	6	38	6/38	man-made
C	6	51	6/51	collapse/stone/cement
C	3	56	3/56	collapse/stone/cement
C	7	62	7/62	collapse/stone/cement
D	9	78	9/78	stone/cement/gravel
E	22	77	22/77	rubble/gravel
F	30	72	30/72	man-made
G	36	75	36/75	collapse/occupation/stone/cement/gravel
H	22	36	22/36	possible small bldg./activity area
I	25	22	25/22	man-made
J	21	52	21/52	cluster of stone/cement
K	38	69	38/69	cluster of stone/cement
KK	28-38	53-60	28/53	high-resistivity area
L	20	54	20/54	iron objects
M	36	40	36/40	individual iron object with surrounding debris
N	1	71	1/71	iron object
O	3	21	3/21	iron object
O	5	23	5/23	iron object
O	1	23.5	1/23.5	iron object

Table 6. Summary of survey results at Site 14RY152.

Feature	N	E	Preserve	NRHP Relevance	Priority	Comments
A	16	42	unknown	unknown	4	linear features are seldom geological
B	6	38	low	unknown	3	central feature with rectangular surround
C	6	51	unknown	unknown	2	possible rectangular cluster associated with C(s)
C	3	56	unknown	unknown	2	possible rectangular cluster
C	7	62	unknown	unknown	2	possible rectangular cluster associated with C(s)
D	9	78	unknown	unknown	4	none
E	22	77	unknown	unknown	4	appears associated with F and possibly D and possibly D and possibly D
F	30	72	unknown	unknown	2	separation region between activity areas
G	36	75	unknown	yes	2	associated with rock cellar to the north
H	22	36	low	yes	2	a weak rectangular high-resistivity area
I	25	22	high	unknown	3	feature truncated by survey edge
J	21	52	unknown	unknown	3	none
K	38	69	unknown	unknown	3	none
KK	28-39	53-60	unknown	unknown	2	none
L	20	54	high	unknown	1	individual and clustered iron objects/tools
M	36	40	high	high	1	precise location uncertain, 36N 40E +/-2m
N	1	71	high	high	1	none
O	3	21	high	high	1	precise location uncertain, +/- 1 m
O	3	23	high	high	1	precise location uncertain +/- 1 m
O	1	23.5	high	high	1	precise location uncertain +/- 1 m

Note: 1 = Highest Priority, 4 = Lowest Priority

A pattern of small circular white spots can be seen in Figure 4. Many of these appear to measure about 2 m in diameter. It is possible that these low-resistivity spots are associated with the tree root-ball structure of an orchard that is reported to have been at this site (see Chapter 5). The remaining features probably represent agricultural or military soil disturbances.

Farmstead Site 14RY2118

Site Description

Site 14RY2118 is a historic farmstead that includes the remains of a barn and corral complex, as well as a probable house, cellar, fences, and other features. Situated on a west facing slope (Figure 7), the site is in grass with an occasional tree. All soils are shallow to very shallow and the underlying bedrock is lime-

stone. East of 80-m E the soils are less than 0.5-m thick and that area was not surveyed (Figure 8).

The site was surveyed with a twin-electrode resistivity configuration, an electrode separation of 0.75 m, and a data sample density of 1x1 per meter. This configuration provided soil resistivity information from 20 to 100 cm below the surface. Large area high-contrast features at depths greater that 100 cm were also expected to be discernable in the data. Figure 8 presents the resistivity survey results.

A detailed magnetic survey was not performed. A cursory magnetic survey throughout the areas of interest indicated a high density of very strong magnetic features interpreted as historic iron objects. These objects would obcure more subtle features associated with intrusive stone, pits and disturbed soils.

Survey Results

The 14RY2118 resistivity data are dominated by geological phenomena (Figure 8). The principal features include a north-south running ridge of high resistivity (designated as Features D and DD) and two southwest-northeast oriented triangular areas of very low resistivity (B and BB) (Tables 7–9). A small area designated as Feature OO represents a contact between the high- (D and DD) and low-resistivity (B and BB) areas. Features A, AA, C, and CC are transition regions between the very low-resistivity areas (B and BB) and a large area of higher resistivity (which appears as light and medium gray in Figure 8).

Table 7. Description of geophysical features at Site 14RY2118.

Feature	N	E	Geophysical Description
A	76	42	transition - high to low resistivity
AA	66	44	transition - high to low resistivity
B	70	40	low resistivity area between A and AA
BB	88	76	low resistivity area between C and CC
C	90	70	transition - high to low resistivity
CC	78	66	transition - high to low resistivity
D	46	52	transition - high to low resistivity, N/S oriented
DD	26	57	transition - high to low resistivity, N/S linear
E	35	76	rectangular feature, mid resistivity
F	35	67	rectangular feature, very high-resistivity
OO	80	58	contact connecting regions B and BB

Table 8. Cultural interpretation of geophysical features at 14RY2118.

Feature	N	E	Trench	Cultural Interpretation
A	76	42	74/42	possible quarry face
AA	66	44	66/44	possible quarry face
B	70	40	70/40	deep moisture rich soils
BB	88	76	88/76	water catchment/water resource management
C	90	70	90/70	possible quarry face
CC	78	66	78/66	possible quarry face
D	46	52	46/52	possible quarry face
DD	26	57	26/57	possible quarry face
E	35	76	35/76	unknown
F	35	67	35/67	possible building
OO	80	58	80/58	a very narrow, moist contact connecting regions B and BB

The following explanation of the 14RY2118 resistivity map (Figure 8) is consistent with site topography, soil, and bedrock characteristics, and the presence of a running spring at approximately 130N 95E:

- Feature BB represents a low-resistivity, moist deposit of silts and fine sediments. Feature B is similar to and downstream from BB. The deeper, moist soils (B and BB) are intrinsically low resistivity.

- Shallow, well-drained soils overlying the bedrock combine with the limestone to create the high-resistivity areas (Features D and DD).

- Runoff and spring flow is constrained by local topography and passes through the bedrock contact at OO.

- Features E and F are interpreted as cultural features. Both features are rectangular; E is characterized by moderately high-resistivity values, whereas F is very high. Feature F may be associated with architectural remains.

Feature Testing

Much of the archaeological record at 14RY2118 is above ground. A variety of architectural remains, including cellars and walls, are evident on the surface. Although Features E and F are clearly cultural, they do not appear to have any surface expression. Feature F, in particular, represents a high priority for archaeological investigation. Additional test units might be excavated to test several expectations about the site. One expects the soils in area BB, and to a lesser extent in B, to be deep and moist. The water resource available upstream (off the map) from OO may have been purposefully managed for agricultural or domestic use. Table 9 prioritizes testing for these and other geophysical features identified at the site.

Table 9. Summary of survey results at Site 14RY2118.

Features	N	E	Preservation	NRHP Relevance	Priority	Comments
A	76	42	high	unknown	2	possible natural outcropping which has been quarried
AA	66	44	high	unknown	2	possible natural outcropping which has been quarried
B	70	40	unknown	unknown	4	moisture rich fine soils/clay
BB	88	76	high	unknown	2	if spring fed from NE would provide water for stock, etc.
C	90	70	high	unknown	2	possible natural outcropping which has been quarried
CC	78	66	high	unknown	2	possible natural outcropping which has been quarried
D	46	52	high	unknown	2	possible natural outcropping which has been quarried
DD	26	57	high	unknown	2	possible natural outcropping which has been quarried
E	35	76	unknown	unknown	4	possible activity area
F	35	67	high	unknown	1	possibly associated with E
OO	80	58	high	yes	1	probable area associated with water resource management

Note: 1 = Highest Priority, 4 = Lowest Priority

Farmstead Site 14RY2170

Site Description

This historic farmstead is situated on a gentle west-facing slope. The underlying bedrock and soil types are unknown, although vehicular disturbance suggests a deep clay/loam layer (Figure 9). The vegetation consists of mostly grass.

The site was surveyed with a twin-electrode resistivity configuration, an electrode separation of 0.75 m, and a data sample density of 1x1 per meter. This configuration provides soil resistivity information in the range of 20- to 100-cm depth. Large-area, high-contrast features at depths greater than 100 cm were also expected to be discernable in the data.

A detailed magnetic survey was not performed. A cursory magnetic survey throughout the areas of interest indicated a high density of very strong magnetic features, doubtless historic iron objects that would obscure the more subtle archaeological features associated with intrusive stone, pits, and disturbed soils.

Survey Results

The resistivity survey of 14RY2170 suggests a heavily disturbed site with a few recognizable high-resistivity features (Figure 10, Tables 10–12). No significant low-resistivity features are present.

Table 10. Description of geophysical features at Site 14RY2170.

Feature	N	E	Geophysical Description
A	85.5	21	localized high-resistivity feature
B	76.5	40	well head
C	68	29	10x10 m high-resistivity feature
D	48	27	8x8 m high-resistivity feature
E	51	57	localized high-resistivity feature
F	17	25	localized high-resistivity rectangular feature
G	12	44	large "rectangular" mid resistivity feature
H	63	77	2x4 m high-resistivity feature

Table 11. Cultural Interpretation of geophysical features at Site 14RY2170.

Feature	N	E	Trench	Cultural Interpretation
A	85.5	21	85.5/21	stone/cement
B	76.5	40	76.5/40	well head
C	68	29	68/29	possible stone/cement floor/rubble
D	48	27	48/27	possible stone/cement floor/rubble
E	51	57	51/57	stone/cement
F	17	25	17/25	possible floor
G	12	44	12/44	heavily disturbed possible floor
H	63	77	63/77	stone/cement

Table 12. Summary of survey results at Site 14RY2170.

Feature	N	E	Preservation	NRHP Relevance	Priority	Comments
A	85.5	21	unknown	no	4	none
B	76.5	40	unknown	unknown	4	well head
C	68	29	unknown	unknown	2	disturbed
D	48	27	unknown	unknown	3	none
E	51	57	unknown	unknown	4	none
F	17	25	unknown	unknown	3	none
G	12	44	poor	unknown	2	robbed or destroyed floor
H	63	77	unknown	unknown	2	interesting high-resistivity feat

Note: 1 = Highest Priority, 4 = Lowest Priority

Feature Testing

Site 14RY2170 has been heavily disturbed by vehicular traffic. If archaeological testing is performed, Features C, D, F, G, and H probably offer the greatest potential for identifying intact deposits. Feature C appears to be heavily disturbed with high-resistivity components redistributed. Table 12 prioritizes the features for archaeological investigation.

Farmstead Site 14RY2171

Site Description

Site 14RY2171 is a historic farmstead that is now divided into two parts by a recently constructed tactical concealment area. Both portions of the site include a depression and several building foundations. The southern half of the site is situated on a relatively level surface, whereas the northern portion slopes gently to the west (Figure 11). The underlying soils and bedrock are unknown. The vegetation consists mostly of grasses with an occasional tree.

The site was surveyed with a twin-electrode resistivity configuration, an electrode separation of 0.75 m, and a data sample density of 1 x 1 per meter. This configuration provided data on soil resistivity from 20 to 100 cm below the surface. Large-area, high-contrast features at depths greater than 100 cm were expected to also be discernable.

Survey Results

The survey maps from 14RY2171 are dominated by high-resistivity features (Figures 12 and 13, Tables 13–15). Most of these features are in the immediate vicinity of a surface depression and building foundation, both of which can be seen on the site surface. Features C and G have no surface expression. The three features jointly designated as C are very localized and are probably individual stones or cement pieces. Feature G is a rectangular, dense cluster located west of a building foundation. This feature could be building debris from site destruction or remnants of some unknown activity area.

Feature E consists of a well-defined, high-resistivity cluster that contains a very low-resistivity interior. The low-resistivity interior feature is probably associated with moist clay soils or perhaps a north-south oriented metal pipe. Feature E may represent a water resource.

Table 13. Description of geophysical features at Site 14RY2171.

Feature	N	E	Geophysical Description
A	108	9	high-resistivity area
S	112	39	cluster of high-resistivity features
C	101	37	cluster, three localized high-resistivity features
C	101	41.5	cluster, three localized high-resistivity features
C	99	43.5	cluster, three localized high-resistivity features
D	90	36	5x6 m area, high-resistivity feature
E	86	61	combined high-resistivity feature with adjacent linear low res.
F	36	44	distributed high-resistivity feature
G	22	35	large cluster high-resistivity objects
H	113.5	21	localized low-resistivity feature

Table 14. Cultural interpretation of geophysical features at 14RY2171.

Feature	N	E	Trench	Cultural Interpretation
A	108	9	108/9	probably geological
S	112	39	112/39	stone/cement/rubble/wall collapse
C	101	37	101/37	stone/cement
C	101	41.5	101.5/41.5	stone/cement
C	99	43.5	99/43.5	stone/cement
D	90	36	90/36	possible floor/collapse
E	86	61	86/61	water resource/cement/stone structure
F	36	44	36/44	stone/cement collapse
G	22	35	22/35	floor/rubble/activity area
H	113.5	21	113.5/21	localized moist area

Table 15. Summary of survey results at Site 14RY2171.

Feature	N	E	Preservation	NRHP Relevance	Priority	Comments
A	108	9	unknown	unknown	4	none
S	112	39	unknown	unknown	2	building material or occupational debris
C	101	37	unknown	unknown	3	interesting cluster highly localized
C	101	41.5	unknown	unknown	3	interesting cluster highly localized
C	99	43.5	unknown	unknown	3	interesting cluster highly localized
D	90	36	unknown	unknown	2	none
E	86	61	good	yes	1	well/spring house/ agricultural structure
F	36	44	unknown	yes	2	none
G	22	35	unknown	yes	1	interesting cluster west of foundation
H	113.5	21	unknown	unknown	3	none

Note: 1 = Highest Priority, 4 = Lowest Priority

Feature Testing

Features E, F, and G appear to have the greatest integrity. The localized features within B, C, and D may also be associated with intact deposits. Test trench design and placement for features of interest should follow the methods suggested in "Test Unit Placement" in Chapter 2.

Army City Site 14RY3193

Site Description

Army City (14RY3193) was a civilian-owned complex that provided entertainment and other services to troops stationed at Fort Riley during World War I. Located just east of Camp Funston, Army City was a complex of buildings, roads, and empty lots that covered an area of approximately 400 x 400 m (Figures 14 and 15). Among the buildings was the Hippodrome, a very large theater. Some of the complex was destroyed by fire and the remaining buildings were dismantled or moved (to Ogden) in the mid-1920's. The site now occupies a grassy field with little or no discernible evidence of the buildings and roads present there 75 years ago. The site's alluvial soils appear to be relatively deep and there is no evidence of near-surface bedrock.

Army City was surveyed with a twin-electrode resistivity configuration, an electrode separation of 0.75 m, and a data sample density of 1x1 per meter. This configuration provided soil resistivity information from 20 to 100 cm below surface. Large-area, high-contrast features at depths greater than 100 cm were also expected to be discernable in the survey data.

The resistivity data and numerous architectural features mapped during an initial, relatively small-scale survey in the eastern portion of Army City in 1996 clearly indicated the usefulness of twin-electrode resistivity survey methods at the site. A full-site resistivity survey of Army City was implemented rather than partial site surveys using both resistivity and magnetics because the former promised to be more useful to Fort Riley CRM.

Survey Results

The Army City survey revealed a large number of high- and low-resistivity features (Tables 16–18). The scale of the Army City survey was so great that it is not practical to describe or even list every feature. In the following discussion, the principal features and areas of interest are summarized. Geophysical and

cultural interpretations of the selected features are discussed in very general terms.

Figure 16 is a small format map of the twin electrode resistivity survey data. The scale of this figure is such that only large features can be seen. Figure 17 shows a selected portion of the site (the Hippodrome Theater area) at a scale of 1:200. Note that many of the geophysical features discussed below are, in fact, rather large areas that include multiple archaeological features (as the latter are typically defined in the field by archaeologists).

Feature A is a random distribution of high-resistivity features. It could be an accumulation of rocks, gravel, and construction rubble.

Table 16. Description of geophysical features at Army City, 14RY3193.

Feature	N	E	Geophysical Description
A	252	74	random distribution of local high-resistivity features
B	222	64	linear array of small high-resistivity objects
C	202	54	12x6 m high-resistivity features
D	182	56	none
E	148	68	10x12 m high-resistivity feature
F	140	108	20x8 m high-resistivity feature
G	196	122	complex 20x30 m high-resistivity feature
H	74	140	20x60 m articulated high-resistivity feature
I	51	164	8x10 m high-resistivity feature
J	60	176	8x10 m high-resistivity feature
K	54	190	12x8 m high-resistivity feature
L	238	130	low-resistivity feature (representative sample)
M	222	139	high-resistivity feature (representative sample)
N	142	78	linear array of small resistivity features
N	140	88	linear array of small resistivity features
N	150	87	linear array of small resistivity features
N	146	104	linear array of small resistivity features
N	152	102	linear array of small resistivity features
O	162	90	array of linear rectangular high-resistivity features
P	202	78	unknown region between linear features
Q	60	105	rectangular pattern of small high and low-resistivity features
R	150	350	linear low-resistivity feature, 250 m long
S	284	320	buried stream bed with tributary
T	265	180	extensive series of low-resistivity tracks
U	300	260	random cluster of high-resistivity objects
V	140	255	very large multi component high-resistivity features
W	115	240	rectangular cluster of very high and low-resistivity features

Table 17. Cultural interpretation of geophysical features at Army City, 14RY3193.

Feature	N	E	Trench	Cultural Interpretation
A	252	74	252/74	cement/stone rubble
B	222	64	222/64	cement/stone/gravel footings
C	202	54	202/54	building remnant
D	182	56	182/56	interior of major architectural structure
E	148	68	148/68	building remnant
F	140	108	140/108	building remnant
G	196	122	196/122	building(s) remnant
H	74	140	74/140	building remnant
I	51	164	51/164	portion of building remnant
J	60	176	60/176	building remnant-rubble
K	54	190	54/190	building remnant-rubble
L	238	130	238/130	clay/high moisture geo feature
M	222	139	222/139	gravel/sand low moisture geo feature
N	142	78	142/78	cement/stone/gravel footings
N	140	88	140/88	cement/stone/gravel footings
N	150	87	150/87	cement/stone/gravel footings
N	146	104	146/104	cement/stone/gravel footings
N	152	102	152/102	cement/stone/gravel footings
O	162	90	162/90	an "L" shaped array of small buildings/shops
P	202	78	202/78	possible road
Q	60	105	60/105	footings or pilings
R	150	350	150/350	possible buried metal pipe
S	284	320	284/320	buried stream bed
T	265	180	265/180	possible vehicle tracks
U	300	260	300/260	stone and cement rubble
V	140	255	140/255	possible building remnant with extensive high-resistivity feature to northwest
W	115	240	115/240	building remnant

Feature B is a linear array of high-resistivity features that are clearly associated with the surrounding architecture. The Feature B array may show footings, piers, or other elements of building foundations. In any event, the archaeological material is high-resistivity and very localized.

Feature C is a high-resistivity area northwest of the Hippodrome. It may consist of a cement floor or a dense accumulation of cement/stone/brick rubble or gravel.

Feature D is a very large, continuous, high-resistivity feature with internal structure. This feature represents building remains associated with the Hippodrome.

Table 18. Summary of survey results at Army City, 14RY3193.

Features	N	E	Preservation	NRHP Relevance	Priority	Comments
A	252	74	high	unknown	4	rocks, gravel, construction debris
B	222	64	high	yes	2	feature associated with road, walkway, building, or walls
C	202	54	high	yes	1	possible building, rubble filled cellar, cement pad
D	182	56	unknown	yes	2	30x40 m area within a high-resistivity, wall-like enclosure
E	148	68	high	yes	1	possible building, rubble-filled cellar, or cement pad
F	140	108	high	yes	1	possible building, rubble-filled cellar, or cement pad
G	196	122	high	yes	1	possible building, rubble-filled cellar, or cement pad
H	74	140	high	yes	1	possible building, rubble-filled cellar, or cement pad
I	51	164	high	unknown	2	possible building, rubble-filled cellar, or cement pad
J	60	176	high	unknown	2	possible building, rubble-filled cellar, or cement pad
K	54	190	unknown	unknown	3	possible building, rubble-filled cellar, or cement pad
L	238	130	none	no	4	possible clay or organically rich soil
M	222	139	none	no	4	possible gravel, sand, or low moisture geological formation
N	142	78	high	unknown	2	road, walkway, or building walls
N	140	88	high	unknown	2	road, walkway, or walls
N	150	87	high	unknown	2	road, walkway, or walls
N	146	104	high	unknown	2	road, walkway, or walls
N	152	102	high	unknown	2	road, walkway, or walls
O	162	90	very high	yes	1	array of connected buildings adjacent to D and E
P	202	78	low	yes	2	section of road near Hippodrome
Q	60	105	unknown	unknown	2	possible frame building footings
R	150	350	high	unknown	3	modern pipeline?
S	284	320	high	unknown	4	buried stream bed
T	265	180	high	unknown	4	post-occupation vehicle tracks
U	300	260	unknown	unknown	3	possible fill associated with grading of buried stream area
V	140	255	unknown	unknown	2	possible building remnants
W	115	240	high	yes	1	large area with remains of multiple buildings

Feature E is a high-resistivity, rectangular feature with internal structure. It appears to be a mid-sized building on the south corner of the Hippodrome complex.

Features F through K are high-resistivity, rectangular features with internal structure.

Feature L is a north-south oriented region of very low resistivity. Its orientation does not suggest association with the architecture to the south. Feature L may contain a large cluster of conductive metal or it may simply be a moist, clay region.

Feature M is a random distribution of small, high-resistivity features. It could be an accumulation of rocks, gravel, or construction rubble.

Feature O is a fascinating group of high- and low-resistivity features that strongly suggests an assembly of small buildings. The high-resistivity features outlined the building periphery and are presumably stone, cement, or gravel footings. Behind the buildings is a linear array of very low-resistivity features that suggests buried metal pipe or very moist clay/organic-filled trenches.

Feature P is a low-resistivity area associated with the road in front of the Hippodrome (Feature D). Other areas in Army City also contain low-resistivity "vehicle" tracks. One portion of these tracks is designated as Feature T.

Feature Q shows the faint outline of a relatively large building or rectangular enclosure. The interior is not filled with cement/stone/rock/rubble, suggesting a corral or outdoor storage area.

Feature R is northeast-southwest oriented, low-resistivity, and crosses the entire surveyed area. A buried metal pipe is the most likely interpretation.

Feature S is a large area of high-resistivity features. The random distribution of these high-resistivity features suggests heavily disturbed soils with buried occupation debris (e.g., stone, cement, etc). Note also that this feature area surrounds a buried stream bed. The absence of the stream on the contemporary site surface suggests that extensive grading and filling may have taken place in this area.

Feature T consists of linear, low-resistivity, track-like features that extend northwest from the east central edge of the surveyed area, and then turn southwest toward the Hippodrome (Feature D). These features are presumably

vehicular tracks and may be associated with salvage and demolition activity in the 1920's.

Feature V is a multi-component, high-resistivity area with internal structure oriented northwest-southeast. Surrounding this feature and extending more than 30 m to the northwest is an equally large but somewhat lower resistivity area. The high-resistivity component appears to be oriented along the Army City street system. Feature V may represent the remains of a building.

Feature W is a high-resistivity, rectangular feature with internal structure.

The necessity of a large-scale map for data analysis and test unit placement becomes clear when comparing Figures 16 and 17. Figure 17 shows much greater detail with grid lines at 1-m intervals and a scale of 1:200.

Feature Testing

Table 18 specifies inferences about the quality of preservation of archaeological deposits associated with the Army City geophysical features, and prioritizes the geophysical features for archaeological investigation.

Army City 14RY3193 South

Site Description

In this report, Army City South refers to a small area south of the railroad tracks (Figures 14 and 15). This area was grass covered with a few small cement and/or limestone blocks visible on the surface. The soils here appeared to be relatively deep, but the area had been disturbed on the north by the railroad and on the west by the levy. Army City South was surveyed using the same instrument configuration as used for the rest of the site.

Survey Results

The Army City South maps display a number of small, localized, high-resistivity features and two low-resistivity features (Figures 18–20, Tables 19–21). Feature A is a linear, low-resistivity feature, possibly a trench. Feature F is a small, localized low-resistivity feature. All other features in the South survey area are localized and high-resistivity — presumably stone, brick, or cement.

Table 19. Description of geophysical features at Army City South, 14RY3193.

Features	N	E	Geophysical Description
A	30	10	low-resistivity linear intrusion
B	27	2	highly localized high-resistivity feature
B	24	5	highly localized high-resistivity feature
B	17	12	highly localized high-resistivity feature
B	12	24	highly localized high-resistivity feature
B	34	31	highly localized high-resistivity feature
C	21	34	4x6 m high-resistivity feature
D	24	26	12x16 m high-resistivity feature
E	23	19	localized high-resistivity feature
F	17.5	22	localized low-resistivity feature

Table 20. Cultural interpretation of geophysical features at Army City South, 14RY3193.

Feature	N	E	Trench	Cultural Interpretation
A	3	10	30/10	possible back filled trench or robbed
B	27	2	27/2	stone/cement block, gravel/stone-filled pit
B	24	5	24/5	stone/cement block, gravel/stone-filled pit
B	17	12	17/12	stone/cement block, gravel/stone-filled pit
B	12	24	35788	stone/cement block, gravel/stone-filled pit
B	34	31	34/31	stone/cement block, gravel/stone-filled pit
C	21	34	21/34	building remnant
D	24	26	24/26	building(s) remnant/rubble
E	23	19	23/19	stone/cement blocks
F	17.5	22	17.5/22	possible back-filled pit

Table 21. Summary of survey results at Army City South, 14RY3193.

Features	N	E	Preservation	NRHP Relevance	Priority	Comments
A	30	10	unknown	unknown	3	possible clay or organically rich soils
B	27	2	high	unknown	3	possible building, rubble-filled pit, stone slab or cement block
B	24	5	high	unknown	3	possible building, rubble-filled pit, stone slab or cement block
B	17	12	high	unknown	3	possible building, rubble-filled pit, stone slab or cement block
B	12	24	high	unknown	3	possible building, rubble-filled pit, stone slab or cement block
B	34	31	high	unknown	3	possible building, rubble-filled pit, stone slab or cement block
C	21	34	good	unknown	3	feature appears near corner of large area of high-resistivity
D	24	26	high	good	2	possible building rubble
E	23	19	high	unknown	3	highest local resistivity feature present
F	17.5	22	unknown	unknown	1	possible trash pit

Feature Testing

Table 21 provides inferences about the preservation of features identified at Army City South, and prioritizes those features for archaeological investigation.

Discussion and Recommendations

The Surveys

Field work and data processing proceeded normally. The field methods were appropriate to the sites, and the field crew proved to be very good. Over a 3-week period, a number of operators collected data at a mean rate of 23 minutes per 20x20-m grid. Optimum survey design and monitoring of data by the operators ensured high data quality with a dynamic range greater than 1:1000. In the Army City survey, for example, there are recognizable cultural features in the range 0.1 to 20 Ohms.

Data Display and Processing

The Army City data have a very large dynamic range. Cultural features smaller than 0.1 Ohm can be seen throughout the map. Simultaneously, high-resistivity features associated with dense concentrations of building debris exceed 20 Ohms. There are regions where the dynamic range of the data exceeds 1:2000. Conventional (linear) highpass filters cannot be used because the distortion they introduce obscures small, low-contrast features.

Display of large, dynamic range data in printed format is difficult because no satisfactory single mapping/graphics method is available. Contour maps with too many contour lines become confusing, and half-tone maps are limited in the number of gray levels. A batch-processed nonlinear highpass filter used in combination with a hybrid gray-scale contour map format offers one viable but labor intensive solution to the problem. All Army City data in this report were processed and presented using these methods.

The Farmsteads

The farmstead surveys were all relatively small. Data processing and display was straightforward because the data files were small and the dynamic range of the farmstead data was relatively limited. Features with archaeological potential were identified and prioritized.

Army City

Cultural features abound at Army City. There appear to be streets, roads, alley ways, buried pipelines, buildings, heavily disturbed soils, building foundations full of collapse and rubble, buried metal pipes running parallel to stone/cement foundations, vehicle tracks, and a buried stream bed.

Processing and display parameters used to create the Army City maps are "median" parameters. That is to say, the contrast and statistical spread (standard deviation) used to create the gray-scale portion of the maps were chosen to render a map that displays most of the features. By increasing the graphics contrast, it is possible to further enhance small (1 m) low-contrast resistivity features. In a similar vein, the high-resistivity features (primarily dense concentrations of building debris) can be examined in detail by means of very low-contrast half-tone maps with contour overlays.

By further processing and creating graphics that enhance the subtle features or more fully display the detail of internal structure available in the high-resistivity features, it is possible to obtain additional information beyond that presented in the "median" maps of this report.

Test Unit Placement

To optimize ground-truthing efforts, test units must be placed very accurately (+/- 25 cm). The principal prerequisites for accurate placement are a reliable field grid and map data traceable to the field location at this tolerance. Modern total station survey methods can provide an adequate grid for the survey as well as the ability to relocate features after the geophysical survey has been completed. The maps provided in this report have a position defect less than +/-10 cm (estimated one standard deviation error). Given these resources, it is possible to examine the resistivity survey data at 0.25-m level of detail and design and place test units and trenches accordingly.

Interpretations of the results of the Army City resistivity survey are enhanced by both large-format and large-scale maps. Large format maps that show the entire survey area at a reasonable scale are particularly useful in managing the site. To this end, large-format 1:500 and 1:600 scale maps of Army City were prepared and submitted to Fort Riley along with the present report. Large-scale maps are also useful in that they enhance the potential to locate ground-truthing test units very accurately.

Recommendations

A central issue that limits the use of geophysics in CRM is the perceived and actual cost. A study conducted at Fort Riley in 1996 (Hargrave 1998) demonstrated that geophysics can be incorporated into NRHP eligibility assessments without increasing project cost. The cost effectiveness of geophysical surveys in archaeology would be vastly improved by providing the field surveyor and archaeologist with improved software tools. The results at Army City demonstrate the effectiveness of well-designed surveys. The automated survey equipment combined with portable computers ensure efficient and reliable data collection. The principal cost effectiveness problems seem to revolve about the following issues:

- adequate and appropriate survey design
- standardized and interactive data processing
- vastly improved data display methods.

Improving data display methods is difficult because of the limited gray-scale constraints of conventional printers. Improvement requires some form of hybrid graphic that is capable of simultaneously rendering the "weak" and "strong" features present in many surveys. This hybrid graphic must also be fully integrated with some form of nonlinear data processing because the use of conventional (linear) highpass filters introduces unacceptable defects as discussed earlier.

Software survey design tools that will ensure adequate and appropriate survey design specifications and procedures should be developed. Well-known and understood methods based on site geometry, geomorphology, archaeological record, and survey purpose exist. They need to be coded into an interactive software format that is "user friendly" from the archaeologist's point of view.

Interactive data processing and display algorithms would probably reduce by half the labor presently required to process and display high dynamic range data. This too is a straightforward software tool development issue.

4 Archaeological Investigations: Background, Research Design, and Methods

by

Thomas K. Larson and Dori M. Penny

Introduction and Background

This chapter discusses the research design and field methods used in the archaeological investigations carried out by LTA, Inc. at Fort Riley, Kansas between 5 June and 3 July 1997. Fieldwork consisted primarily of brush clearing, site gridding, mapping, and the excavation of shovel tests and test units. The investigations were designed to ground truth resistivity studies carried out by Geoscan Research (USA) and to assess the NRHP eligibility of the sites investigated. Ground truthing, as the term is used in this report, refers to investigation by means of excavation of the subsurface phenomena that may account for the presence of geophysical anomalies.

All sites investigated during this project date to the historic period. They included five farmsteads (14GE1108, 14RY152, 14RY2118, 14RY2170, and 14RY2171) and Army City (14RY3193), a World War I entertainment center.

Chapters 4 and 5 deal specifically with the archaeological investigations. Geophysical findings and interpretations are presented in Chapters 2 and 3 (see also Somers 1998).

Environmental Setting

Fort Riley is in northeastern Kansas, approximately 5 to 15 km west of Manhattan. The entire post is within the Flint Hills region of the Osage Plains section of the Central Lowlands physiographic province (Fenneman 1938; Jewitt 1941). Elevations at the fort range between approximately 340 and 410 m above mean sea level.

This area of Kansas is within the lower Kansas River basin. The Kansas River proper forms much of Fort Riley's southern boundary, while a portion of the Republican River, now impounded by Milford Lake, is along the fort's western boundary.

The terrain on Fort Riley is primarily a result of exposures of Permian limestone bedrock and stream channels filled with Pleistocene and Holocene alluvium. The scarp-forming Fort Riley and Florence limestones have created the upland hills and ridges north of the Republican River valley.

The project area has a continental climate "characterized by warm to hot summers, cold winters, abundant sunshine, moderate winds, low to moderate humidity, and a pronounced peak in rainfall late in the spring and during the first half of the summer" (Jantz et al. 1975:67). The average precipitation is 80.3 cm (31.6 in.), 75 percent of which falls between April and September.

The uplands of Fort Riley support a tall-grass prairie dominated by a bluestem community (Kuchler 1964). The vegetation of the wooded valley bottoms has been summarized by Largent and Waite (1995:10):

> Thickly wooded areas are common along waterways in the project area, and may be indicative of the recent encroachment of the Eastern Deciduous Forest into the project area. Ground cover consists of . . . grass and herbaceous species and various briars (*Rubus*), while the observed understory is dominated by sumac (*Rhus glabra* and *R. copallina*), and black (honey) locust (*Robinia pseudo-acacia*) and maple (*Acer* sp.) saplings. Overstory is dominated by large oak (*Quercus*) and hickory (*Carya*) species, and juniper (*Juniperus*), with the occasional cottonwood (*Populus* sp.), black walnut (*Juglans nigra*), sycamore (*Platnus occidentalis*), elm (*Ulmus*), box-elder maple (*Acer negundo*), hackberry (*Celtis* sp.), bois d'arc (*Maclura pomifera*) and larger black locust present...

History of the Study Area

Between 1826 and 1850, when the American military was establishing its presence at Jefferson Barracks, Fort Leavenworth, and Fort Atkinson, the Pawnee and the Kansa were still occupying the valleys of the Republican, Smoky Hill and Kansas rivers. The relocation of eastern tribes, such as the Sauk, Fox, and Delaware, was also taking place. Increased pressure from various Native American groups (e.g., the Arapaho and the Cheyenne) on the major overland routes in the late 1840's and early 1850's made it clear that another military post

between Fort Leavenworth and Fort Atkinson was needed. In 1852, Colonel T.T. Fauntleroy, formerly the commanding officer at Fort Leavenworth, wrote the Quartermaster General regarding the need for this post "at or near a point on the Kansas River where the Republican fork unites with it" (Pride 1926:60–61).

The site for Fort Riley, near the confluence of the Smoky Hill and the Kansas River, was selected in 1852 by a board of officers appointed by General U.S. Clarke (Pride 1926:61). The fort was initially called Camp Center, but the name was changed after the death of Major General Bennett Riley in 1853 (Pride 1926:61).

Troops were stationed at Fort Riley to protect travelers on the Santa Fe Trail, the Smoky Hill Road, and the Oregon Trail (Pride 1926; O'Brien 1989; Zornow 1957). The route of the Oregon Trail went north of the fort through Marysville. The Santa Fe Trail went south of the fort through Fort Zarah. The Smoky Hill Road went through Fort Riley, as did the Leavenworth and Pikes Peak Express (Townley 1994).

Congress appropriated the first construction funds for Fort Riley in 1853. The area was opened for civilian settlement with the passage of the Kansas-Nebraska Act in 1854. Because of the highly politicized nature of the Kansas-Nebraska Act, eastern Kansas settled rapidly. Manhattan, Lawrence, and Topeka were settled by groups sponsored by abolitionists. Pawnee, now within the Fort Riley reservation, was settled by Southern sympathizers in September 1854. Pawnee was the site of the first territorial legislature in 1855 (Zornow 1957; O'Brien 1989). Also in 1855 the Army forced the abandonment of the town after it was discovered that it was within the boundaries of the fort. A partial reconstruction of the First Territorial Capitol building is present at the site of Pawnee.

Other settlements were established near the same time as Pawnee. Junction City was founded in 1855, and Ogden was settled between 1854 and 1856. Percival G. Lowe, First Sergeant of Troop B, First Dragoons and later superintendent of transportation at Fort Riley, describes a few other settlements in the vicinity of the post in 1855.

> There was no settlement in the immediate country. There was one family at the bridge across the Little Blue [probably the bridge across the Big Blue at the military road crossing; see Pride 1926:71], nineteen miles east, and a Catholic mission and Pottawatomie village of St Marys, fifty-two miles east ... Captain Alley's store at Silver Lake, the Pottawatomie homes and the eating

> place at Hickory Point, finishes the list of settlements, save here and there at long intervals a squatter's shanty (Pride 1926:71–73).

Although a lack of population was perceived by Lowe, Kansas came close to reaching the congressional ratio of 93,420 residents and was admitted as a state in 1861 (Gates 1968:305–306).

During the Civil War, Fort Riley was mostly staffed by volunteer troops; the only permanent personnel were some of the non-commissioned officers, the sutler, and the chaplain (O'Brien 1989:12; Pride 1926:143). Large numbers of troops were stationed temporarily at the fort. These troops included the First Kansas and the 12th and 13th Wisconsin (Pride 1926).

Despite the war, civilian settlement in Kansas continued to increase throughout the 1860's. The passage of the Homestead Act in 1862 increased the opportunities to obtain land. Gates (1968:403) estimates that approximately 780,000 acres were ultimately acquired under homestead or preemption laws in eastern Kansas. This figure represents most of the 1,180,000 acres of unsold land in this area in 1862. By the time the railroad reached Ogden and Junction City in 1866, the eastern half of Kansas was substantially settled.

> By the early 1870s, markets in eastern Kansas became established and farmers had adapted their farming techniques to the Prairie-Plains environment... However, the depression of 1873 that resulted from overexpansion in agricultural production, railroad and land speculation, and overextended credit, coupled with the drought and grasshopper infestations of 1874 to 1876, slowed Kansas's growth until after the mid 1870s... In the 1880s, the economy quickly expanded, as railroads were extended across the state, numerous communities were platted, land values rose, and the price of corn and wheat peaked. Except for a minor setback in 1883 and the instability of farm prices, Kansas' economy continued its growth until 1890 (Schmits et al. 1987:160).

The five farmstead sites investigated as part of this project were all established in the last half of the 19th century. Sites 14RY152 (1862) and 14RY2118 (1868) are from the period immediately after the passage of the Homestead Act; 14GE1108 (1874) appears to have been first occupied during the depression years in the early 1870s, and 14RY2171 (1885) and 14RY2170 (1895) were settled during the growth period near the end of the century.

During the early 20th century, many farms were consolidated to increase their profitability. Steam and gasoline powered machinery began to replace horse drawn equipment in the years before World War I. Farm product prices soared

after the United States entered the war and land values increased. Many farmers continued to enlarge their holdings in reaction to higher prices. The fall in prices subsequent to World War I created some of the economic instability that culminated in the Great Depression (Larson and Penny 1998).

Fort Riley was one of 32 mobilization centers established after the United States entered World War I. Camp Funston was established as a temporary cantonment just prior to World War I. A total of 1,401 buildings were constructed in a 3-month period at the camp (O'Brien 1989:15).

Army City, one of the areas studied during the 1997 investigations, was established to take advantage of the business opportunities provided by Camp Funston. Arthur Jellison, a banker in Junction City, financed and planned much of Army City (Rion 1960:15–16). The land Army City was built on was purchased for him in June 1917 by Hale P. Powers, who Rion (1960:15) refers to as an entrepreneur and farmer. Construction began in July 1917 (Rion 1960:2).

Jellison and Powers formed two corporations — the Army City Townsite Improvement Company and the Army City Service Company — in order to obtain a charter for the town from the State Charter Board (Rion 1960:17). Walter Ziegler and Roy Dalton were two stockholders who later owned a garage, filling station, and rental properties in Lots 1, 2 and 3 of Block 5 (Rion 1960:31). Ziegler had other businesses, probably including a market or restaurant (Rion 1960:31). Although other stockholders may have owned businesses in Army City, this has not yet been documented.

The Army City Townsite Improvement Company proceeded with plans for construction immediately.

> A surveying firm prepared a plat of the town site which outlined a site consisting of thirty blocks, five east-west streets, and five north-south streets. Most blocks contained twenty-four lots, each lot being twenty-five feet by one hundred and twenty feet in size. The streets were sixty feet in width and the alleys were sixteen feet wide (Rion 1960:18).

The townsite plat, which includes block and lot numbers, is illustrated in Rion's thesis. The street design and some buildings within Army City are also shown on a U.S. Army map produced in 1917 (Figure 14).

Sale of 250 business and residence lots was advertised in June 1917 (Rion 1960:18). The sale was to take place on 1 and 2 August 1917. Contracts between the Army City Townsite Company and purchasers read, "It is further covenanted

and agreed . . . that all buildings shall be erected upon the Mission Style and of Stucco . . ." (Rion 1960:23). In Army City, the only non-Mission Style building for which Rion provided a photograph was the Log Cabin Restaurant (Rion 1960).

Early publicity had proudly announced that Army City would be a model town containing only fireproof buildings. All buildings would be concrete, stucco, or brick and would meet all safety requirements. Most of the business buildings did have stucco exteriors. But under the thin layer of stucco was a layer of tarpaper, a wood frame, wood floors, and the "frosting on the cake" — the tarpaper roofs used on most of the buildings (Rion 1960:79).

Although the sale of lots did not take place until 1 and 2 August, construction began during the first or second week of July. A 12 July 1917 Manhattan Tribune article stated that "[t]he ditches for sewer and water pipes can be seen in the alleys between the streets. Foundations of stone and cement for the huge buildings to come are being laid. Carpentry activity is high as floors are laid and timbers raised." It is presumed that "the huge buildings to come" refers to buildings being financed by the stockholders of the Army City Townsite Improvement Company in the main business district. This business district extended "along Washington Street and spread east and west on General and Colonel Streets" (Rion 1960:32).

> Two theaters [the Hippodrome and the Orpheum] dominated the main business district in Army City. One and two-story buildings, all in the Spanish Mission style of architecture, housed the various establishments. A bank was established and the town had its own post office. Restaurants, pool halls, drug stores, grocery stores, photo studios, tailor shops, military stores, dry-goods stores, a lumber yard, a hotel, and two wholesale houses were established in Army City.
>
> The Townsite Company donated land to several churches. The Salvation Army erected a citadel, the Lutheran Church built a religious and social center, and the YWCA erected a large and popular Hostess House (Rion 1960:2).

The Orpheum and Hippodrome theaters had a combined capacity of 3,500 patrons (Rion 1960:48). The six restaurants listed by Rion (1960:50) include the Palm Garden, the Log Cabin, the Paris Arbor, the Mason Cafe, and Sechler's Lunch Room; the sixth restaurant is not named. Sechler also owned a souvenir stand and a pool hall. The pool hall was next to the lunch room. The Hammond Publishing Company, a Manhattan firm, established a two-room office "to serve as a news gathering house [for the *Army City Bulletin*] and eventually as a printing plant" (Rion 1960:45–46).

Based on reports that Funston would be made permanent after the war, construction and investment in the community continued.

> By April 1918 Army City's official population was 304. The population was so fluid and there were so many semi-permanent residents that some visitors estimated the population at 1,500 or even greater. The total assessed valuation of the community, according to 1918 figures, was $367,880, which was greater than that reported for Randolph and slightly less than the figures for Ogden and Leonardville (Rion 1960:37).

Army City became incorporated in April 1918 (Rion 1960:41). The first mayor was Roy Dalton, an original stockholder. All city records were destroyed in an August 1920 fire (described later). This information places the city building in either Block 4 or Block 5 (Rion 1960:41). Rion (1960:41) also states that records dating after August 1920 were destroyed in a 1935 flood.

Very little is known about the residential area of Army City. Rion (1960:32) describes an area east of the main business district as a cluster of several private homes. Many employees and business owners apparently lived in apartments in the business district. A group of three small buildings in the extreme southeastern part of the town may represent some of these private homes.

In 1917, the U.S. Army was segregated. A business district and probably a residential area for black soldiers and their dependents was built south of the Union Pacific Railroad line. "South Army City provided a pool hall, barber shop, restaurant [Prince George Restaurant], YWCA Hostess House, and a theater for the use of the colored troops who were barred from similar activities on the north side of the railroad tracks" (Rion 1960:36–37).

Even if Camp Funston was made permanent, the stockholder's were aware that Army City would need an industrial base to survive fluctuations in the Camp's population. Although a number of different possibilities were discussed, none of them materialized (Rion 1960:77–78). By 1919, mustering out of troops had begun and businesses in Army City began to close.

The population of Army City had dropped to approximately 200 people by the 1920 Census (Rion 1920:78). In August 1920, a fire started in an apartment in the Hippodrome building in Block 5. Approximately 20 minutes later, the fire had spread throughout Blocks 4 and 5 (Rion 1960:80). The Hippodrome Theater, the Orpheum Theater, the Dillner Photo Shop, the Haarmyer News and Tobacco Store, the Davis Tailor Shop, the Mason Cafe, the O. B. Scott Variety Store, the Ziegler-Dalton Garage and Filling Station and a number of apartments were

destroyed. Rion (1960:81) estimates that 15 to 20 families were left homeless. The fire finished any hopes for an economic recovery in Army City.

> Government in Army City ended in September of 1922. At that time six of the town's eight remaining citizens met at Watson's Cleaning Plant to vote on the future of the city. All six voted to unincorporate and Army City was through. The land encompassed by Army City returned to the Township and the city records were turned over to the Clerk of Ogden Township. Army City was officially vacated by the Riley County Commissioners in 1926 (Rion 1960:87).

A.D. Jellison reacquired all of the land except for Lots 13 and 14 in Block 2 which were retained by the Watson and Hussey families (Rion 1960:87). The land owned by Jellison was purchased by Fred Yenni for farming in 1925 (Rion 1960:88). The last business in what was once Army City, the Watson Cleaning Plant in Block 2, relocated to the east edge of Ogden in 1941 when the area became part of Fort Riley (Rion 1960:87–88).

In the 1920's and 1930's, large-scale unemployment, falling farm product prices, and environmental hardships adversely affected the area surrounding Fort Riley. The hardships of the Great Depression were not alleviated until the military-industrial buildup just before and during World War II (Larson and Penny 1998).

In 1939, President Franklin D. Roosevelt declared a limited state of emergency and issued an EO authorizing an increase in the strength of the Armed Forces. At Fort Riley, Camp Funston was reactivated. Camp Forsyth was established as a cantonment and later served as the Cavalry Replacement Training Area. In 1942, the Army purchased a tract north of the existing fort for increased training activities (Larson and Penny 1998). All five farmstead sites discussed in this report were acquired by the government during this period.

Research Objectives

The SOW for this project states that it "is designed to field test a site assessment strategy based on the use of geophysical survey techniques and limited but highly targeted 'ground-truthing' excavations." Additionally, the work was to "produce a written report on the eligibility status of Army City (14RY3193) and at least four (4) farmstead sites for nomination to the National Register of Historic Places" (U.S. Army 1997:1, 2).

From the onset of this project, it was recognized that the two objectives of the study (i.e., ground truthing and NRHP evaluation), especially given a predefined level of effort, might not be completely compatible with one another. From the standpoint of decisions made in the field, ground truthing was normally given precedence; if the information gained during that effort also yielded sufficient information to make a NRHP eligibility recommendation, one has been presented. If insufficient data were recovered to assess eligibility, that has been stated in the site summaries.

Although the geophysical contractor conducted some magnetic studies, the primary emphasis was on resistivity. The research questions involved with ground truthing the resistivity features at both the farmsteads and Army City are specified below:

a. At a given resistivity feature/anomaly, are there any characteristics found in the archaeological record that might explain or aid in defining what the feature is?

b. If such characteristics are detected, do they indicate that the feature is a result of natural forces, historic occupation, post-occupation disturbances, or some combination of all three factors?

c. Do the locations of resistivity features serve to indirectly indicate the location of artifact concentrations or other important archaeological data that do not themselves create a resistivity signature?

d. Are certain resistivity feature shapes and/or sizes more archaeologically productive than others?

e. What is the best means of testing resistivity features?

While the basic ground truthing goals of the research were the same at Army City and the farmsteads, the historic contexts are considerably different. In reporting on historic site inventory work on Fort Riley, Halpin and Babson (1997) enumerate a number of research topics for farmsteads:

> Research topics relevant to farmsteads at Fort Riley include, but are not limited to, site location and patterning, the ethnicity of the occupants, and material culture. Some questions that can be addressed by archaeology include the following: 1) Are the earliest farmsteads located within the drainages? 2) Do upland sites reflect differences in age and functions than those located in drainages? 3) Does the number and spatial patterning of outbuildings reflect

> age and function? 4) Are differences in ethnicity (such as the Welsh around Bala) reflected in site form, site patterning, and material culture? 5) What role does building material play in defining the attributes of farmsteads . . . ? 6) How does the material culture located at these sites reflect their age and function? 7) Are kin-based settlement patterns present within the project area? 8) What was the impact of the Dust Bowl and the Great Depression upon the project area?" (Halpin and Babson 1997:121).

After completing a testing phase at some of the historic sites, Halpin (1997) proposed several other eligibility criteria:

> It is recommended that factors such as age, association with important persons or families, and specialized function be used in conjunction with archaeological integrity when making NRHP [National Register of Historic Places] evaluations. . . . Early and briefly occupied historic sites that were hand razed, or simply abandoned, appear to have the potential to yield information concerning lifeways in the Flint Hills region and thus may be eligible for NRHP nomination (Halpin 1997:142,149).

During the same site testing program, archaeological integrity (or actually the lack of it) became the key factor in determining that the eight sites investigated were not eligible for nomination. Although not specifically enumerated in the Halpin report, indicators of limited integrity appear to have included: temporally mixed artifact assemblages, a lack of midden areas, a lack of subsurface features, damage to visible architectural features, erosion of the cultural level, and soil compaction and other disturbances caused by military vehicles. These assessments appear reasonable and were generally followed during the present study. Once farmsteads are discovered that do not have these problems, however, it seems critical to further assess the potential significance of the archaeological assemblage before making any NRHP assessment. To this end, and taking into account previously posed research questions for farmsteads, the following questions were addressed:

f. Within the distribution of artifacts over the site area, are there patterns indicative of definable activity areas?

g. If midden or dump areas are present, can they be functionally and/or spatially linked to other observable site features?

h. Does the artifact assemblage indicate occupational patterns that are not obvious in the historical documents?

i. Are curated items present that might indicate the ethnic ties or the geographic origin of the original occupants of the farmstead?

At Army City, the question of NRHP eligibility was approached almost exclusively from the perspective of site integrity rather than historical significance. It is believed that the history of Army City (e.g., Rion 1960) clearly demonstrates that the site is a unique form of entertainment center built during an important era in American history. As such, it is eligible for the NRHP under Criterion A. Prior to the 1997 testing, however, it was unclear whether the site retained sufficient physical integrity to be of value in investigating the material culture of the World War I era. In other words, does the site retain a significant archaeological assemblage that would be eligible for the NRHP under Criterion D?

In discussing Army City, Kreisa and Walz (1997:99) summarize three research topics developed by Babson (1997) that they believe are most pertinent in evaluating the significance of the site:

1. The investigation of civilian-military interaction at Fort Riley

2. The impact of World War I on Fort Riley

3. The investigation of racial segregation at the site and whether or not the segregated facilities were "separate but equal."

While information contributing to these research domains forms worthwhile long-term goals, from a practical standpoint, it is believed necessary to first gather more information about what remains of Army City, specifically from a spatial perspective. Because of this, several somewhat more basic research questions were used to guide the 1997 investigations. Rion (1960) describes various elements of the site: commercial, residential, and Army City South. From Rion's descriptions, these areas can very likely be identified on the 1917 map shown in Figure 14. From this basic background information, the following questions are posed:

j. Are archaeological remains present at these locations?

k. Are structural remains present that would correspond to the 1917 map, historic photos, and available descriptions of the site?

l. Are there detectable differences in the artifact assemblages from the three areas that would bolster the idea that each served a separate function?

m. Can the burned area of Army City (Blocks 4 and 5) be detected and is its artifact assemblage different from that of the unburned portions of the commercial district?

Methods

Fieldwork

Immediately before beginning the fieldwork, the five farmsteads to be investigated were selected by the Fort Riley CRM staff. The four primary sites were 14RY152, 14RY2118, 14RY2170, and 14RY2171. A fifth site, 14GE1108, was selected as an alternate in case fieldwork at one of the other four was not possible.

The first task completed at the farmsteads was clearing the "core areas" of vegetation using a gas-powered bush hog. According to the SOW, the core area is "that portion of the site where the remains of the house and the main cluster of outbuildings are expected to occur" (U.S. Army 1997:4). Once brush clearing was accomplished, a grid system was established over the core area. The grids were oriented on magnetic north. Ideally, the grid was to be a pattern of stakes at 20-m intervals. Around the perimeter of some of the farmsteads, smaller 10x10-m and 10x20-m areas were sometimes laid out in order to avoid major topographic breaks, dense tree cover, and other obstructions.

The Army City site is in a hay meadow and no brush clearing was necessary before staking the site area. The site was gridded off of a baseline established during earlier investigations at the site (Kreisa and Walz 1997). Unlike the farmsteads, a 40x40-m grid pattern was specified for Army City. The entire area containing Army City was staked. Additional gridding was done in an area south of the Union Pacific tracks that it was thought might contain a portion of "Army City South." Another 40x40-m area south of the tracks was later laid out and investigated by personnel from Geoscan Research.

All sites were mapped using an electronic total station. Surrounding terrain features, cultural material observable on the surface, and the locations of all areas of archaeological investigation were included on the site maps. A site datum consisting of a 12-in. steel spike was placed at each site. To maintain a record of the grid orientation at each site, two additional spikes were placed 20 m out, at right angles to the datum points, along the grid lines.

Site datum points were recorded using a global positioning satellite (GPS) receiver. Rover points at the site marker were gathered using a sampling

frequency of 180, a minimum of four satellite vehicles, a position dilution of precision of ^{3} 4, and a sampling rate of one sample per second. All GPS data were gathered using Universal Transverse Mercator coordinates and the 1927 North American Datum (NAD) horizontal datum. Differential correction of the rover files was accomplished using hourly data files downloaded from the Bureau of Land Management/University of Wyoming community base station in Casper. Table 22 is a listing of the pertinent information for each site datum.

All shovel tests and test units were excavated in 10-cm arbitrary levels. At farmsteads, shovel testing took place at 10-m spacing and at geophysical features defined by Geoscan Research. At Army City, selected geophysical features in the western and southern part of the site were shovel tested.

Except in several areas of Army City where cultural materials proved to be excessively deep, shovel test and test unit excavations extended at least 20 cm into culturally sterile sediments. Excavation information was maintained on standardized forms.

All excavated soil was screened through 1/4-in. mesh. Soil texture and Munsell color information was compiled for each shovel test and test unit. Within the formal test units, level floor plans and the profiles of at least two walls of the excavation were drawn and photographed in color and black and white. All excavations were backfilled.

Besides the archaeological fieldwork, basic historical information was gathered for the five farmsteads. This consisted of chain of title information gathered at the Register of Deeds Offices for Riley and Geary counties and tax information gathered at the Riley County Assessor's Office and the Riley County Museum.

A total of 625 hours were logged in the field during this project. Table 23 presents a breakdown of the labor expended for the various tasks.

Table 22. Site datum information.

Site	Grid Location	UTM (Zone 14) East/North	20 m Offset Spikes from Datum
14GE1108	80mN/60mE	683687/4335599	south and east
14RY152	00mN/80mE	677264/4352447	north and west
14RY2118	100mN/80mE	690015/4335407	south and west
14RY2170	60mN/40mE	688684/4341454	south and west
14RY2171	80mN/60mE	688992/4341732	north and west
14RY3193	240mN/300mE	697387/4331281	south and west

Table 23. Summary of fieldwork expenditures (person hours).

Army City	staking	69
	site mapping	25
	shovel tests	45
	test units	134
Farmsteads	Brush clearing and staking	108
	historical research	12
	site mapping	32
	shovel tests	72
	test units	128

Artifact Analysis

For the most part, in order to maintain consistency, artifact analysis for this project closely followed the methods developed for previous studies at farmsteads on Fort Riley (e.g., Halpin 1997:40–44) and Army City (Kreisa and Walz 1997:61–63). With some reworking, the approach generally follows South (1977) in that artifacts are placed within "groups" that are, at least ideally, "based on functional activities related to the systematic context reflected by the archeological record" (South 1977:93). Within South's classification system, intervening categories of "ware," "material," and "class" are used between individual artifact types and groups. Because of the wide variety of artifacts encountered, especially at Army City, these subdivisions were not used during the 1997 analysis.

Several minor differences exist between the earlier studies and the one presented in this report. During shovel testing, items that were clearly "modern military" were not retained. From test units, however, all items were bagged for laboratory analysis. Because of these differing collection strategies, the "modern military" group is probably underrepresented when one compares this study to previous investigations.

In describing bottle glass colors, the terms "purple tinted" and "aqua tinted" have been used to describe sun-altered glass that has turned color because it contains either manganese or iron. Intentional glass colors (brown, green, etc.) do not have the term "tinted" attached.

The only aboriginal artifacts recovered during this project are flakes of Florence chert from Army City. Rather than placing the materials in the "other" group (e.g., Kreisa and Walz 1997), they have been placed in a "prehistoric" group in order to provide easy separation from the historic assemblage.

5 Results of Archaeological Investigations

by

Thomas K. Larson and Dori M. Penny

The Farmsteads

14GE1108

This farmstead was chosen as a fifth, alternate location to be investigated only if archaeological studies were not possible at the other four farmsteads (14RY152, 14RY2118, 14RY2170, and 14RY2171). Because it was possible to carry out the studies at the other four sites, archaeological testing was not done at 14GE1108. However, the site was mapped, gridded, and basic archival research was completed.

Site 14GE1108 was originally recorded by Cooprider (1979). It was revisited in 1993 as part of a CERL historic site inventory survey (Halpin and Babson 1997). One large structure, probably a barn, and four other building foundations were reported during both of the earlier investigations. The 1993 site form for 14GE1108 refers to the site as the "Gottfried Strauss farmstead" and notes that a patent for the 80 acres surrounding the site was issued to Strauss on 5 September 1881. Site condition was evaluated as "Good," indicating "surface impacts that do not substantially affect potential to recover archaeological information" (Halpin and Babson 1997:71, 96).

When visited in 1997, 14GE1108 was in essentially the same condition as described on the 1993 site form. There is a large irregularly shaped foundation and depression in the southwest part of the site that almost certainly represents a barn (Figure 1). Approximately 30 m northeast of the barn is a depression, two rock foundation walls, and a concrete pad that make up various elements of a house and an associated cellar described by Cooprider (1979) when they were in a better state of preservation. Farther to the northeast, two piles of rock rubble and a rock foundation probably represent the locations of small outbuildings.

On 2 and 3 July 1997 attempts to locate the tax records relating to 14GE1108 were unsuccessful. Although contacts were made with the County Assessor (who

physically searched a county warehouse), the County Treasurer's Office, and the Geary County Historical Society, no detailed tax records could be found for the site area. The title information on 14GE1108 is quite complete, however, and it is not believed that significant historical data were missed by the failure to find the tax records. The title search at the Geary County Register of Deeds Office indicates the site's history of private ownership (Table 24).

Without additional archaeological investigations, it is not possible to access the NRHP eligibility of 14GE1108. As noted on the 1993 site form, military impacts to the site appear to be minimal. Much of the site's original spatial patterning and building layout appears to be intact. Although Strauss's patent was not registered with the county until 1881, it was actually issued by the government in 1874. Allowing a minimum of 5 years to improve the property, this would mean that occupation of the site had to have started no later than 1869. As such, 14GE1108 appears to fall into the "1853 - 1880 Establishment of Farms" period of significance and it has the potential to answer research questions posed for that period (e.g., Halpin and Babson 1997:63). The importance of 14GE1108 to these areas of research cannot be assessed, however, until the integrity of the subsurface deposits is evaluated.

14RY152

Site 14RY152 was originally recorded by Cooprider (1979). It was revisited in 1993 as part of the Halpin and Babson (1997) historic sites inventory survey. NRHP eligibility evaluation investigations at the site were carried out in 1996 by the University of Illinois at Urbana-Champaign (UIUC) (Halpin 1997). This work included archival research, mapping, and the excavation of 102 posthole tests and four 1x2-m test units. "It was selected for NRHP testing based on the possibility of an early short-term occupation and surface observations that indicated good potential for subsurface site integrity" (Halpin 1997:72).

Based on research presented in Halpin (1997), 14RY152 is the Almon D. Phelps farmstead. The site was occupied by the Phelps family from 1862 or 1863 until

Table 24. Chain of title information for the 80 acres in the NW 1/4 of the SE 1/4 and the SW 1/4 of the NE 1/4, Section 28, T. 10 S., R. 5 E.

Date	Instrument	Grantor	Grantee	Reference
9/5/1881	Patent (issued 12/15/1874)	United States	Gotterfried Strauss	B Misc., p. 154
8/14/1923	Warranty Deed	Otto R. Strauss	Joseph Marten et al.	Deed Book 17, p 576
1/24/1934	Warranty Deed	Joseph Martin et al.	A.F. & A.O. Fawley	Deed Book 22, p 546
6/3/1936	Warranty Deed	A.F. & A.O. Fawley	Nora Martin	Deed Book 24, p 498

1888. Although the artifact assemblage indicates some use of the site after that date, these later occupations were probably short-term events.

The site today consists of a large cellar lined with uncut limestone and a cultural material scatter containing late 19th and early 20th century artifacts. Although the testing in 1996 recovered artifacts associated with the site's original occupation, these were found in a disturbed context.

> SARThe posthole tests and four 1-x-2-m test units indicated that the area has been subject to a significant amount of erosion, and the mixed content of the artifact assemblage suggests that the remaining soils have been disturbed [by] vehicular activity and the excavation of military fox holes. Although the site had the potential to yield large amounts of data concerning early settlement in the Bala area, it appears to have been severely disturbed by military training. As such, 14RY152 does not appear to be NRHP eligible, and no further work is recommended (Halpin 1997:83).

Because of the level of the investigations already completed at 14RY152, the 1997 fieldwork at this site was somewhat less than at the other tested farmsteads. After brush clearing, six 20x20-m squares were laid out on magnetic north. The Geoscan Research investigators later conducted studies in a seventh uncleared square at 20 to 40 m N and 40 to 60 m E. In the process of mapping 14RY152, two of the test units and a site marker from the 1996 investigations were also identified (Figure 3).

At 14RY152, Geoscan Research conducted both a resistivity study and a partial magnetometer investigation. This resulted in the identification of 13 resistivity features (A, B, C1, C2, C3, D–K) and 6 magnetic features (L, N, O1, O2, O3) (Tables 4 and 5).

Although the magnetic anomalies were shovel tested by LTA, selection of the locations for the two test units was restricted to areas containing resistivity features. Following discussions with Lewis Somers of Geoscan Research, it was decided that the best locations for the two test units would be the linear areas of transition between high- and low-resistivity features that demonstrated a linear pattern. Accordingly, Test Unit 1 was excavated near the center of Feature A; Test Unit 2 was excavated over the northeast to southwest edge of L-shaped Feature F (see Figure 3).

Shovel tests were excavated at the remaining resistivity anomalies and all of the magnetic anomalies. These 16 shovel tests were positioned using coordinates supplied in the Geoscan tabular data (Table 5). The shovel tests ranged from 10

to 30 cm in depth, all ceasing at the contact with either a compacted clay or limestone bedrock. Six artifacts were recovered from four locations (Table 25).

Test Unit 1 was excavated to 30 cm. A 1- to 5-cm thick band of silty clay at the top of the unit yielded six of the eight artifacts recovered (Figure 21a*). Below this band is a stratum of compacted reddish brown clay. The two pieces of sheet metal recovered from this lower stratum appear to be intrusive, probably pushed slightly into the clay by vehicle tires or treads.

Test Unit 2 was also excavated to 30 cm. While the band of silty clay encountered in this unit was slightly thicker than that in Test Unit 1 (Figure 21b), Test Unit 2 contained no cultural material.

Although much smaller in size and less temporally sensitive, the characteristics of the artifacts recovered at 14RY152 in 1997 are generally similar to those described by Halpin (1997:79–82). The 1997 artifact assemblage is dominated by the Architectural Group. The predominance of machine cut nails over wire nails suggests a late 19th to early 20th century age for the assemblage. The glass button from Shovel Test I may have been manufactured at an earlier date. Its presence in the assemblage at 14RY152 is probably reflective of a curated item. The level of disturbance at the site is consistent with the conclusions reached by Halpin (see quote on page 57). The artifact assemblage is contained within a thin and eroded component near the surface. Post occupational activities on the site appear to have disturbed and mixed the cultural level.

Table 25. Artifacts from Site 14RY152.

Provenience	Depth BS	Group	Item	Count
ST I	10 to 20 cm	Clothing	4 hole glass button	1
ST J	00 to 10 cm	Architecture	wire nail	1
	00 to 10 cm	Kitchen	semi-vitreous china	1
ST L	00 to 10 cm	Architecture	machine-cut nail	1
ST M	00 to 10 cm	Architecture	brick fragment	1
	00 to 10 cm	Architecture	machine-cut nail	1
TU 1	00 to 10 cm	Architecture	flat glass	1
			machine-cut nail	2
		Kitchen	clear bottle glass	2
			undecorated stoneware,	1
			manganese ext./unglazed int.	1
			Other coal/clinker	1
TU 1	10 to 20 cm	Activities	sheet metal	2

Note: ST = Shovel Test, TU = Test Unit, BS = Below Surface

* Figures are placed at the end of the report.

Neither Test Unit 1 nor Test Unit 2 yielded clues for the causes of the linear, high- resistivity/low-resistivity patterns indicated by geophysical studies. Halpin's research may, however, provide a explanation for the parallel and perpendicular lines of resistivity in the southeastern part of the site (see Figure 3, Features B, C, D, etc). In his description of an 1881 Riley County atlas, Halpin (1997:72) notes that both a structure and an orchard are depicted at the location of 14RY152. Parallel tree rows within an orchard, as well as any intervening cultivation furrows and access paths, might be responsible for the linear patterns noted in the resistivity study.

Oval resistivity features in the northern and central part of the site appear to be the result of recent ground disturbance. At the location of shovel tests within Features H and I, deep ruts were visible on the ground surface. Within Feature K, some form of blading appears to have taken place. Other similarly shaped features such as E, H, and J (Figure 3) may be the result of slightly earlier disturbances that have been covered by vegetation and soil.

The possible detection of the orchard in the southern part of the site indicates patterning related to the original occupation of 14RY152. Either because of recent ground disturbance or because no trees were planted there, this pattern is not present in areas closer to the cellar. Since orchards (if that is in fact what the line patterns are detecting) would not be expected to contain an abundance of cultural material or features, these findings have little bearing on the assessment of site integrity. Based on the 1997 investigations, there is no reason to contradict Halpin's assessment that 14RY152 is not eligible for the NRHP. The type of ground patterning noted may, however, be useful at other farmsteads in terms of defining landscape patterns and searching for features adjacent to past agricultural areas or tree rows.

14RY2118

This site, the Herman Mann homestead, was originally recorded by Cooprider (1979). It was revisited in 1993 as part of the Halpin and Babson (1997) study of farmsteads on Fort Riley. A title search at the Riley County Register of Deeds Office indicated the history of private ownership summarized in Table 26.

Table 26. Chain of title information for 160 acres in the SE 1/4 of Section 30, T. 10 S., R. 6 E.

Date	Instrument	Grantor	Grantee	Reference
6/26/1885	Patent (issued 2/19/1880)	United States	Herman Mann	48, p 59
8/16/1882	Warranty Deed	Herman Mann, et al.	Mary F. Chapin	R, p 20

County tax records indicate that Herman Mann first paid taxes on a house on the property in 1868. Following the 1882 sale to Mary F. Chapin, the property remained in the Chapin family until it was taken over by the Army in 1941. By 1923, ownership had been transferred from Mary to L.F. Chapin. At the time of the Army's acquisition, ownership is listed as Austin Chapin et al.

The site presently consists of a large barn and corral area delineated by a complex series of uncut limestone and boulder foundations, a probable house location with a rock foundation and concrete slab, a rock-lined cellar, a small uncut limestone foundation, and the disturbed remains of a probable cistern or well and an adjoining water trough (Figure 7). Rock fences and rock retaining walls are also south and west of the barn. Artifacts associated with the historic period of use are visible on the surface southwest of the barn and corral area. Some of this material is concentrated in a circular area approximately 10 m in diameter. Except for the excavation of fire pits and fighting positions around the site's perimeter, the only noticeable damage caused by military activities is a small amount of reuse and stacking of the barn's limestone foundation materials.

The Geoscan Research investigators identified 10 resistivity features at 14RY2118 (Figures 7 and 8). These features are described in Tables 7–9. The resistivity features plotted by Geoscan at 14RY2118 are generally long linear contact zones between areas of high and low resistivity. When inspected in the field, some of these zones were found to be on top of or parallel to exposed rock. Features O and OO, indicated as the “convergence” on Figure 7, are in an area of exposed bedrock in one corner of the barn. Features D and DD are parallel to and slightly downslope from a rock retaining wall. Features A and AA roughly parallel, and are interior to, a series of rock walls, retaining walls, and fences that form an L-shaped partial enclosure next to the barn. Feature CC roughly parallels, and is just exterior to, the north wall of the barn. No surface expressions are present to explain the shapes of Features B, BB, and C (Figure 7).

Because of the amount of exposed rock on the surface, shovel testing was not carried out at Features CC, D, DD, O, or OO. Low-resistivity Features B and BB were shovel tested. Three shovel tests each were excavated at right angles across the high/low-resistivity contact lines at Features A and AA. The areas in and around Feature CC were adequately tested with the shovel tests excavated on a 10-m grid (Figure 7).

None of the shovel tests related to resistivity features produced cultural material. Of the 105 shovel tests excavated on a 10-m grid, 36 produced cultural material (Table 27). The positive shovel tests tended to be in the southern and western part of the site. This pattern probably correlates to activities carried out

in the vicinity of the cellar and house (in the southern part of the site) and trash dumping over the hill slope (in the southwestern part of the site).

Except for areas over the hillside, the shovel tests at 14RY2118 tended to be shallow, with limestone bedrock encountered from 10 to 20 cm below the present ground surface. Within this limited amount of deposition, however, there appears to be an extensive artifact assemblage (Table 27).

Table 27. Artifacts from shovel tests at Site 14RY2118.

Provenience	Depth BS	Group	Item	Count
ST 4	10 to 20 cm	Architecture	machine-cut nail	1
ST 9	00 to 10 cm	Mod Military	ammunition clip	1
ST 18	00 to 10 cm	Kitchen	semi-vitreous china	1
ST 19	00 to 10 cm	Kitchen	clear bottle glass	1
ST 20	00 to 10 cm	Activities	square nut	1
ST 24	10 to 20 cm	Kitchen	spoon or fork handle	1
ST 25	00 to 10 cm	Activities	metal bucket fragment	1
	10 to 20 cm	Activities	metal bucket fragment	1
	10 to 20 cm	Architecture	wire roofing nail	1
ST 38	10 to 20 cm	Activities	iron rod or pin	1
ST 39	00 to 10 cm	Activities	sheet metal	1
ST 40	00 to 10 cm	Kitchen	clear panel bottle glass	1
ST 41	00 to 10 cm	Activities	sheet metal	1
	00 to 10 cm	Kitchen	semi-vitreous china	1
ST 54	10 to 20 cm	Kitchen	purple tinted glassware	1
ST 57	00 to 10 cm	Architecture	flat glass	1
	00 to 10 cm	Architecture	stove pipe fragments	2
	10 to 20 cm	Architecture	flat glass	1
	10 to 20 cm	Architecture	stove pipe fragments	5
	10 to 20 cm	Personal	rubber boot fragment (?)	1
	20 to 30 cm	Architecture	stove pipe fragments	3
	20 to 30 cm	Kitchen	clear bottle glass	1
ST 59	10 to 20 cm	Activities	cast iron fragment	1
	10 to 20 cm	Architecture	flat glass	1
ST 62	00 to 10 cm	Kitchen	brown bottle glass	1
ST 63	00 to 10 cm	Kitchen	bone fragment	1
	00 to 10 cm	Kitchen	clear bottle glass	3
	00 to 10 cm	Kitchen	metal cruet closure	1
	00 to 10 cm	Kitchen	semi-vitreous china	1
ST 65	00 to 10 cm	Kitchen	light green canning jar glass	1
ST 69	10 to 20 cm	Activities	wire	1
	20 to 25 cm	Activities	wire	1
ST 70	00 to 10 cm	Kitchen	clear bottle glass	4
ST 71	00 to 10 cm	Architecture	machine-cut nail	1

Provenience	Depth BS	Group	Item	Count
	00 to 10 cm	Architecture	machine-cut nail	1
	00 to 10 cm	Kitchen	metal threaded closure	1
	00 to 10 cm	Kitchen	purple tinted bottle glass	1
	00 to 10 cm	Kitchen	undecorated stoneware, Albany slip	1
	10 to 20 cm	Architecture	flat glass	1
ST 72	00 to 10 cm	Kitchen	light green bottle glass	1
	00 to 10 cm	Kitchen	porcelain	1
	00 to 10 cm	Kitchen	semi-vitreous china with gold floral design	1
	00 to 10 cm	Kitchen	undecorated ironstone rim, Albany slip	1
	10 to 20 cm	Kitchen	aqua tinted bottle glass	1
	10 to 20 cm	Kitchen	green pressed glass	1
	10 to 20 cm	Kitchen	undecorated stoneware, Albany slip	1
ST 73	00 to 10 cm	Activities	auto or flashlight bulb base?	1
	00 to 10 cm	Activities	copper rivet	1
	00 to 10 cm	Architecture	machine-cut nail	2
	00 to 10 cm	Architecture	spike	1
	00 to 10 cm	Architecture	wire nail	4
	00 to 10 cm	Clothing	metal button	1
	00 to 10 cm	Furniture	lamp chimney glass	1
	00 to 10 cm	Kitchen	burned undecorated ironstone	2
	00 to 10 cm	Kitchen	clear bottle glass	2
	00 to 10 cm	Kitchen	clear canning jar glass	1
	00 to 10 cm	Kitchen	tin can rim fragment	1
	00 to 10 cm	Personal	1925 penny with perforation	1
	00 to 10 cm	Personal	dark blue bottle glass	1
	00 to 10 cm	Personal	obacco can lid	1
	10 to 20 cm	Architecture	flat glass	2
	10 to 20 cm	Architecture	machine-cut nail	2
	10 to 20 cm	Architecture	wire nail	1
ST 3	10 to 20 cm	Kitchen	brown bottle glass	1
	10 to 20 cm	Kitchen	burned bone fragment	1
	10 to 20 cm	Kitchen	burned undecor. ironstone	4
	10 to 20 cm	Kitchen	cast iron stove fragment	1
	10 to 20 cm	Kitchen	clear bottle glass	3
	10 to 20 cm	Kitchen	light green bottle glass	5
	10 to 20 cm	Kitchen	porcelain	1
	10 to 20 cm	Kitchen	semi-vitreous china with floral decal	1
	10 to 20 cm	Kitchen	tin can fragments	4
	10 to 20 cm	Kitchen	undecorated stoneware, metallic glaze	1
	10 to 20 cm	Personal	dark blue bottle glass	2
ST 74	00 to 10 cm	Activities	sheet metal	1
	00 to 10 cm	Furniture	lamp chimney glass	1
	00 to 10 cm	Kitchen	burned undecor. ironstone	2
	00 to 10 cm	Kitchen	clear bottle glass	1

Provenience	Depth BS	Group	Item	Count
	00 to 10 cm	Kitchen	clear pressed glass	1
	00 to 10 cm	Kitchen	undecorated stoneware, salt & metallic glazes	1
ST 75	00 to 10 cm	Activities	sheet metal	1
	00 to 10 cm	Architecture	flat glass	1
	00 to 10 cm	Architecture	machine-cut nail	1
	00 to 10 cm	Kitchen	brown bottle glass	1
	00 to 10 cm	Kitchen	clear bottle glass	1
	00 to 10 cm	Personal	aqua tinted patent medicine bottle glass	1
ST 76	00 to 10 cm	Kitchen	clear bottle glass	1
	00 to 10 cm	Personal	tobacco can lid	1
ST 83	00 to 10 cm	Activities	sheet metal	1
	00 to 10 cm	Activities	wood screw	1
ST 84	00 to 10 cm	Kitchen	clear bottle glass	1
ST 85	00 to 10 cm	Activities	sheet metal	4
ST 86	00 to 10 cm	Activities	sheet metal	2
ST 87	10 to 20 cm	Kitchen	tin can fragment	1
ST 93	00 to 10 cm	Activities	wire	1
	10 to 20 cm	Activities	strap metal with wire nail	1
	20 to 30 cm	Activities	flask or can with small threaded closure	7
	20 to 30 cm	Activities	metal corner bracket	1
	30 to 40 cm	Activities	flask or can	6
ST 95	00 to 10 cm	Kitchen	undecorated stoneware, metallic glaze	1
ST 96	00 to 10 cm	Activities	wire bail	1
ST 98	00 to 10 cm	Activities	horse shoe nails	2
	00 to 10 cm	Architecture	wire roofing nail	1
ST100	10 to 20 cm	Kitchen	clear bottle glass	1
ST101	00 to 20 cm	Activities	sheet metal	1
	20 to 30 cm	Kitchen	clear bottle glass	1
ST102	00 to 10 cm	Activities	wire	2
ST103	00 to 10 cm	Kitchen	pressed glass with floral design	1
	10 to 20 cm	Kitchen	porcelain	1
	10 to 20 cm	Kitchen	ironstone plate, probably East End China Company1	
	10 to 20 cm	Kitchen	undecorated brownware wide mouth jar	1
	10 to 20 cm	Kitchen	undecorated stoneware, ash & metallic glazes	1
ST106	00 to 10 cm	Activities	sheet metal	1

Note: ST = Shovel Test, BS = Below surface

Test Unit 1 was a 1x1-m unit excavated along an exposed rock face in the northwestern part of 14RY2118. It was placed at this position to see if the quarry activities suggested by Geoscan for the site could be detected. This unit is not, however, at a feature location designated by Geoscan. Once exposed (Figure 22a), the bedrock appeared to be a naturally eroded shelf with no evidence of

quarry operations. It is possible, however, that loose pieces of limestone were collected along the limestone face and used for building foundations and fences. No cultural material was recovered from 30 cm of excavation.

Test Unit 2 was a 1x1-m unit placed within a small U-shaped rock foundation that is interpreted to be part of the barn. The purpose of this test was to determine if artifacts could be recovered that might indicate building function. The test unit was also placed at this location to determine the building interior's potential depth below the present ground surface and to examine Geoscan's proposed bedrock convergence area. Between 30 and 40 cm, a massive amount of apparent demolition debris was encountered and excavation could not proceed any deeper (Figure 22b). Table 28 summarizes artifacts from Test Unit 2.

Test Unit 3 was a 0.5x2-m unit placed over a surface artifact concentration west of the house. A significant number of artifacts were recovered from the upper 10-cm level in this unit (Table 28). Deposition proved to be shallow, with bedrock encountered at 10 to 15 cm (Figure 22c).

Table 28. Artifacts from Test Units 2 and 3 at Site 14RY2118.

Provenience	Depth BS	Group	Item	Count
TU 2	00 to 10 cm	Activities	sheet metal	12
			wire	5
		Architecture	flat glass	1
			wire nail	1
TU 2	10 to 20 cm	Architecture	machine-cut nail	1
			wire nail	3
		Modern Military	cast iron artillery shell fuse?	1
TU 3	00 to 10 cm	Activities	brass sheet metal	1
			cast iron object	1
			metal strapping	1
			mowing machine tooth	1
			wire	4
		Architecture	flat glass	8
			wire nail	2
		Arms	22 long rifle casing with "U" headstamp	1
		Clothing	metal pants button	1
			rubber boot fragments	3
		Kitchen	brown bottle glass	1
			clear bottle glass	30
			clear bottle glass embossed "ER"	1
			clear bead or prescription finish	1
			purple tinted prescription finish	2

Provenience	Depth BS	Group	Item	Count
			clear bottle glass embossed "N" bar "D"	1
			clear pressed glass	1
			purple tinted bottle glass	14
			purple tinted circular bottle base	1
			purple tinted circular bottle base	1
			purple tinted panel bottle base	1
			light green bottle glass	22
			glass canning jar lid insert	3
			clear glass bowl neck	2
			milk glass	1
			pressed glass	1
			blue design transferware	1
			red design transferware	1
			redware	1
			semi-vitreous china	17
			possible Japanese porcelain	1
			stoneware with early Red Wing stamp	1
			undecorated stoneware, Albany slip, ash glaze	2
			undecorated stoneware, iron oxideglaze	1
			undecorated stoneware, manganese glaze	4
			undecorated stoneware, manganese ext./unglazed int.	3
			undecorated stoneware, manganese glaze	2
			undecorated stoneware, manganese glaze & unglazed	1
			undecorated stoneware, pos. ash glaze ext./manganese int.	1
			undecorated stoneware, salt glaze ext./manganese int.	1
			tin can fragments	36
		Personal	bisque doll body fragment	1
			writing slate fragment	1
		Modern Military	.30 cal. bullet	2

Note: TU = Test Unit, BS = Below Surface

In the test units, and perhaps in some of the shovel tests, there are distinct indications of activity patterning. The materials in Test Unit 2, within the barn area, consist primarily of construction debris. Test Unit 3, on the other hand, appears to be an area of trash dumping from the house, primarily kitchen debris.

Although probably a continuous occupation, two periods are indicated in the artifact assemblage. The design elements on the red and blue transfer ware are typical of 1840 to 1865 designs. Additionally, the majority of the stoneware appears to be hand thrown rather than molded. This was generally a pre-1870's manufacturing technique. Assuming some time lag because of artifact curation, it can be inferred that this earlier period of artifacts probably relates to the 20 years Herman Mann owned the property (ca. 1862 to 1882).

The second period represented in the artifact assemblage is believed to be from the 1880's through the 1920's. This period is represented by the purple and aqua tinted bottle glass, a combination of machine-cut and wire nails, the 1925 penny, a fragment of a Red Wing crock with a maker's stamp in use from 1878 to 1892, an ironstone plate stamped with a maker's mark believed to be from the East End China Company in use from 1894 to 1907, and a piece of semi-vitreous dinner ware with a D.E. McNicol maker's mark used from 1914 to ca. 1925.

Although the property remained in private hands until 1941, surprisingly little in the artifact assemblage indicates use of the site in the 1930's and early 1940's. Tin cans, for instance, are not common artifacts and there are no indications of any type of plastic, galvanized metal containers, electrical wiring, or depression era glassware. Rural sites from the 1930's and 1940's also tend to have a general increase in debris deposits that is not evident at 14RY2118. For this reason, it is suspected that the site area was abandoned approximately 10 years before it was purchased by the government.

As noted in the preceding discussion, most of the resistivity patterns at 14RY2118 can be linked to visible surface features. The roughly V-shaped patterns formed between Features C and CC and Features A and AA are interesting and not completely explainable on the basis of archaeological findings. The converging lines tend to form funnel patterns that constrict near the opposite ends of a narrow passageway through the walls of the barn area (see Figure 7). Based on the results from shovel testing, there is no drastic change in deposition that can explain the pattern; both the areas interior and exterior to the "funnels" have very shallow soil deposition on top of limestone bedrock. The areas interior to C - CC and A - AA also tend to have very few artifacts (see Figure 8).

One possible explanation for the two V-shaped patterns is that they reflect areas repeatedly used for entry to and egress from the barn and corral area through the narrow passageway. Repetitive use of these areas by both humans and domestic animals could conceivably have caused sediment compaction or added materials to the soil (such as barnyard manure) that might explain the resistivity pattern.

It is believed that 14RY2118 is eligible for nomination to the NRHP. This concluson relates to the site's early age (ca. 1868), the integrity and complexity of the building remains, and the presence of an artifact assemblage reflective of the site's age and function. To date, military use of the area appears to have had very little impact on the site. Excavation results, especially from Test Unit 3, suggest that artifacts at the site are distributed in patterns related to activity areas and building pattern. Although not fully explored during the 1997 testing, it is likely that areas of deeper soil accumulation, such as the hillside, probably contain midden accumulations in a temporal sequence that is stratigraphically definable. The artifact record also indicates abandonment of the site approximately 10 years prior to Army acquisition. This finding suggests that the deposits are, for the most part, very time-sensitive, with no overlap between the civilian and military use of the site.

The deposits at 14RY2118 also demonstrate the delicate nature of the archaeological materials at relatively undisturbed farmsteads on the post. For the most part, except in the southwestern part of the site, the artifact assemblage at 14RY2118 is in a 10- to 20-cm thick deposit immediately below the present ground surface. Any increase in the level of disturbance at the site, or changes in erosional patterns, could very rapidly destroy or diminish the integrity of this record.

14RY2170

Site 14RY2170 was recorded by John Dendy in May 1994. At the time of the original recording, the site was described as containing the foundations of a house, a silo, and several outbuildings as well as an intact limestone cellar. By the time of LTA's visit to the site in 1997, it was considerably more disturbed and the base of the silo was the only identifiable feature (Figure 9).

A title search carried out at the Riley County Register of Deeds Office indicates the history of private ownership summarized in Table 29. Besides the occupants indicated by deed records, county tax records show that C.E. Gifford paid taxes on the property in 1891 and that Wm. Parrick paid them in 1901. There are no tax records on the property prior to 1891.

Table 29. Chain of title information for 160 acres in the NE 1/4 of Section 12, T. 10 S., R. 5 E.

Date	Instrument	Grantor	Grantee	Reference
10/15/189	Contract (installment)	State of Kansas	F.O. Clark	D Misc., p. 31
12/4/1905	Patent	State of Kansas	Thos. F. Gaden	99, p. 385
3/2/1909	Deed	Thos. F. Gaden et al.	Henry Sylvester	116, p. 328
9/5/1939	Warranty Deed	Henry Sylvester et al.	Bertha Hartner	195, p. 151

The Geoscan Research investigators identified nine resistivity features at 14RY2170. These features are described in Tables 10–12 and their positions are shown on Figures 9 and 10. Somers notes that the data "suggests a heavily disturbed site with a few recognizable high-resistivity features" (Chapter 2, this report). He notes that Feature G might be associated with a heavily disturbed floor of a building. Features C and D were identified as possible stone or cement floors or rubble. Based on this information, Test Unit 1 was placed over Feature C and Test Unit 2 was placed over Feature G (Figure 9). The remainder of the resistivity features were shovel tested. Another 70 shovel tests were excavated on a 10-m grid.

Eighteen of the shovel tests excavated on a 10-m grid contained artifacts (Table 30). Shovel tests excavated at resistivity Features D, E, F, and H also produced cultural material. Besides the materials itemized in Table 30, the shovel test at resistivity Feature F revealed a large piece of dressed limestone, probably part of a building footing or foundation, and the shovel test at resistivity Feature H encountered a large piece of concrete (Figure 9). These items were not collected.

Test Unit 1, located so as to investigate Feature C, was excavated to 30 cm. Cultural materials were recovered from the upper 20 cm (Table 31). A disturbed and mixed band of silty clay (Figure 23a) was encountered from 5 to 20 cm. The band appeared to contain all of the cultural material from the test unit. Below this band was red clay with a platy structure that appeared to be due to compaction by heavy vehicles.

Test Unit 2 was excavated over Feature G, a possible building floor. The unit was excavated to 30 cm. Three artifacts were recovered in the 00 to 10 cm level (see Table 31). As with Test Unit 1, the artifacts appeared to have come from a heavily disturbed level of silty clay (Figure 23b). A stratum of compacted and blocky clay was encountered at approximately 25 cm.

With the exception of one piece of transfer ware and one piece of Rockingham ware, both of which could be from curated items, the artifact assemblage at 14RY2170 appears to date from the first half of the 20th century. This assessment is primarily based on the lack of tinted bottle glass and machine-cut nails.

The majority of the building features at 14RY2170 are also consistent with an occupation during the first half of the 20th century. These characteristics include a tile-lined silo, heavy reliance on concrete (as opposed to limestone) as a foundation material, and steel-pipe well casing. While the limestone-lined cellar noted by Dendy and the piece of dressed limestone found in shovel testing indicate that some earlier construction methods were used at the site, the present

level of disturbance makes it difficult to quantify or determine the position of earlier features.

Table 30. Artifacts from shovel testing at Site 14RY2170.

Provenience	Depth BS	Group	Item	Count
ST D	00 to 10 cm	Furniture	light bulb glass	1
	00 to 10 cm	Kitchen	light green bottle glass	2
	20 to 30 cm	Activities	copper washer	1
	20 to 30 cm	Activities	steel bar or ring fragment	1
	20 to 30 cm	Kitchen	melted bottle glass	1
ST E	00 to 10 cm	Activities	sheet metal	2
	00 to 10 cm	Kitchen	brown floral transfer	1
	00 to 10 cm	Kitchen	clear bottle glass	2
	00 to 10 cm	Kitchen	undecorated stoneware	1
	10 to 20 cm	Kitchen	light green bottle glass	1
	20 to 30 cm	Activities	iron rod	1
	20 to 30 cm	Kitchen	light green bottle glass	3
	20 to 30 cm	Kitchen	pressed milk glass	1
ST 1	00 to 10 cm	Kitchen	glass canning jar lid insert	1
ST 6	00 to 10 cm	Kitchen	tin can fragments	2
ST 9	00 to 10 cm	Architecture	flat glass	1
ST 12	00 to 10 cm	Kitchen	clear bottle glass	1
ST 14	00 to 10 cm	Activities	fencing staple	1
	00 to 10 cm	Architecture	wire nail	1
ST 15	00 to 10 cm	Architecture	wire nail	1
ST 16	00 to 10 cm	Architecture	wire nail	1
ST 18	00 to 10 cm	Kitchen	clear bottle glass	1
ST 24	00 to 10 cm	Kitchen	clear bottle glass	2
	00 to 10 cm	Kitchen	glass canning jar lid insert	1
	00 to 10 cm	Kitchen	semi-vitreous china with painted floral design	1
	00 to 10 cm	Kitchen	undecorated stoneware rim or base, Albany slip	1
ST 33	00 to 10 cm	Activities	monkey wrench jaw	1
ST 35	00 to 10 cm	Activities	fencing staple	1
ST 41	00 to 10 cm	Architecture	flat glass	1
ST 43	00 to 10 cm	Kitchen	light green bottle glass	1
ST 44	10 to 20 cm	Furniture	stove part	1
	10 to 20 cm	Kitchen	light green bottle glass	1
	10 to 20 cm	Kitchen	semi-vitreous china	1
ST 49	00 to 10 cm	Kitchen	glass canning jar lid insert	1
ST 56	00 to 10 cm	Activities	sheet metal	19
	00 to 10 cm	Architecture	wire nail	1
ST 59	00 to 10 cm	Architecture	wire nail	1
ST 60	00 to 10 cm	Kitchen	light green bottle glass	1

Note: ST = Shovel Test, BS = Below Surface

Table 31. Artifacts from Test Units 1 and 2 at Site 14RY2170.

Provenience	Depth BS	GROUP	Item	Count
TU 1	00 to 10 cm	Architecture	flat glass	1
		Kitchen	light green bottle glass	2
TU 1	10 to 20 cm	Activities	cast iron fragment	1
			small copper housing	1
		Architecture	wire nail	1
		Kitchen	brown bottle glass	1
			light green bottle glass	3
			undecorated stoneware, manganese glaze	2
TU 2	00 to 10 cm	Activities	chain belt link	1
		Activities	metal pin or rod	1
		Kitchen	undecorated stoneware, Rockingham	1

Note: PROV = Provenience, TU = Test Unit, BS = Below surface

Neither the test units nor the shovel test results yielded a great deal of information relevant to the nature of the identified resistivity features. If building floors are present in the vicinity of Features C and G, they are broken up to the degree that they are not definable within the artifact assemblage or the soil profiles.

The heavy disturbance noted in the interpretation of the resistivity data is confirmed by the archaeological findings. Besides the two tank trails shown on Figure 9, most of the site area is crisscrossed by vehicle ruts. Whether or not these disturbances have created "false" resistivity images is unknown. What is obvious from the stratigraphy present at the site is that any image generated as a result of human activity is probably on or very near the surface. Nearly all of the artifacts at 14RY2170 appear to come from a thin (10 to 12 cm) and disturbed stratum near the present ground surface. Below this stratum is a dense clay with no evidence of cultural material.

Because of their shallow nature, the cultural deposits at 14RY2170 have been extensively disturbed by military training activities. The only exception to this pattern is the large piece of building stone found in Shovel Test F (Figure 9). Whether this piece of material is responsible for resistivity Feature F is unknown.

Except for the base of a silo, the buildings at the site appear to have been almost destroyed by mechanized traffic and intentional earth moving. No evidence was found of the cellar mentioned on the original site form.

Site 14RY2170 is not believed to be eligible for nomination to the NRHP. This finding is due to the site's lack of physical integrity and considerable disturbance to its original setting.

14RY2171

Site 14RY2171 was recorded in 1996 during the Fort Riley historic sites inventory survey (Halpin and Babson 1997). It is referred to as the Jesse White farmstead. A title search carried out at the Riley County Register of Deeds Office indicates the history of private ownership summarized in Table 32. County tax records go back slightly farther than the deed records and indicate that Daniel Morgan first paid taxes on the property in 1885.

The site contains two relatively undisturbed segments separated by a recently constructed tactical concealment area (TCA). Although cultivation, tree planting, and installation of upright railroad ties around the perimeter of the TCA may have disturbed some site materials, this work does not appear to have impacted any major features. The northern part of the site has large depression and two concrete foundations, and the southern part of the site has a depression and a concrete foundation. The site also contains several small poured concrete features and a fairly dense scatter of demolition and surface artifacts (Figure 11). A concentration of highly fragmented building debris in the vicinity of the southern foundation indicates that the building at this location (probably a house) was intentionally torn down.

The Geoscan Research investigators identified and described 10 resistivity features at 14RY2171 (Figures 11–13, Tables 13–15). The plotted locations are primarily high-resistivity features. The most promising locations appeared to be Features G and E.

Feature G is a dense cluster in a rectangular pattern west of a foundation. Its unknown cultural association could be building debris from the site destruction or remnants of some unknown activity area. No surface expression is present in the vicinity of Feature G (Figure 11).

Table 32. Chain of title information for 160 Acres in the SW 1/4 of Section 6, T. 10 S., R. 6 E.

Date	Instrument	Grantor	Grantee	Reference
4/13/1889	Patent	State of Kansas	Daniel L. Morgan	4, p 13
3/23/1900	Deed	Daniel L. Morgan	Jesse White	89, p 114
3/29/1940	Quit Claim Deed	A.L. Goble (Administrator of J. White will)	Ida B. Hibner et al.	183, p 558

Feature E contains a well-defined, high-resistivity cluster and a well-defined, linear low-resistivity feature. Feature E is parallel to the east wall of a concrete foundation north of the TCA. If the low-resistivity feature is associated with soil moisture (very likely), Feature E may represent an agricultural water resource (Figure 11).

Of the 74 shovel tests excavated at 14RY2171 on a 10-m grid, 22 produced cultural material (Table 33). The eight shovel tests at resistivity Features A, B, C1, C2, C3, D, F, and H yielded subsurface cultural material at Feature H (concrete rubble, not collected).

Table 33. Artifacts from shovel testing at Site 14RY2171.

Provenience	Depth BS	Group	Item	Count
ST 2	00 to 10 cm	Activities	square head machine nut and bolt	1
ST 2	00 to 10 cm	Modern Military	artillery shell fragment	1
ST 7	00 to 10 cm	Kitchen	clear bottle glass	1
ST 8	00 to 10 cm	Kitchen	brown bottle glass	1
ST 12	00 to 10 cm	Kitchen	light green bottle glass	4
ST 16	00 to 10 cm	Kitchen	light green bottle glass	1
	10 to 20 cm	Modern Military	artillery shell fragment	1
ST 17	00 to 10 cm	Activities	metal fragment	1
	00 to 10 cm	Kitchen	undecorated ironstone	1
ST 18	00 to 10 cm	Activities	U-shaped hinge	1
	00 to 10 cm	Activities	carbon battery rod	1
	00 to 10 cm	Activities	copper rivet	1
	00 to 10 cm	Activities	hollow cast iron rod	1
	00 to 10 cm	Activities	iron bar with 3 holes	1
	00 to 10 cm	Activities	rectangular buckle	1
	00 to 10 cm	Activities	steel rivet	1
	00 to 10 cm	Activities	cast iron object	1
	00 to 10 cm	Architecture	wire nail	3
	00 to 10 cm	Kitchen	canning jar glass	1
	00 to 10 cm	Kitchen	clear bottle glass	4
	00 to 10 cm	Modern Military	.30 cal. bullet	1
	10 to 20 cm	Activities	copper grommet	1
	10 to 20 cm	Activities	copper rivet attached to harness fragment	1
	10 to 20 cm	Activities	heavy gauge wire	2
	10 to 20 cm	Activities	sheet metal	3
	10 to 20 cm	Activities	wire fragments	2
	10 to 20 cm	Architecture	composition shingle	1
	10 to 20 cm	Architecture	wire nail	2
	10 to 20 cm	Architecture	wire roofing nail	1
	10 to 20 cm	Kitchen	canning jar glass	3
	10 to 20 cm	Kitchen	clear bottle glass	1

Provenience	Depth BS	Group	Item	Count
	10 to 20 cm	Kitchen	clear bottle glass	2
	10 to 20 cm	Kitchen	pig canine	1
	10 to 20 cm	Modern Military	artillery shell fragment	1
ST 23	00 to 10 cm	Architecture	wire nail	1
	00 to 10 cm	Kitchen	clear bottle glass	1
ST 28	00 to 10 cm	Architecture	wire nail	1
ST 35	00 to 10 cm	Kitchen	flat glass	1
	00 to 10 cm	Kitchen	undecorated stoneware rim, Albany slip	1
ST 36	00 to 10 cm	Activities	sheet metal	2
ST 45	10 to 20 cm	Activities	metal fragment	1
	10 to 20 cm	Architecture	wire nail	1
ST 46	00 to 10 cm	Activities	sheet metal	2
	00 to 10 cm	Activities	wire	1
	00 to 10 cm	Architecture	flat glass	1
ST 50	00 to 10 cm	Kitchen	clear bottle glass	1
ST 53	00 to 10 cm	Architecture	machine-cut nail	1
ST 54	00 to 10 cm	Architecture	brick fragment	1
	00 to 10 cm	Architecture	flat glass	1
	00 to 10 cm	Kitchen	clear bottle glass	2
	00 to 10 cm	Kitchen	clear bottle glass	6
	00 to 10 cm	Kitchen	clear pressed glass	1
	00 to 10 cm	Kitchen	melted clear bottle glass	1
	00 to 10 cm	Kitchen	semi-vitreous china	1
ST 61	00 to 10 cm	Kitchen	light green bottle glass	1
ST 63	00 to 10 cm	Modern Military	artillery shell fragment	1
ST 64	00 to 10 cm	Kitchen	clear bottle glass	1
ST 66	00 to 10 cm	Kitchen	clear pressed glass	1
ST 67	00 to 10 cm	Activities	barbed wire	1
	00 to 10 cm	Kitchen	tin can fragment	1

Note: ST = Shovel Test, BS = Below Surface

Test Unit 1 was excavated at an angle across resistivity Feature E. The unit was excavated 40 cm through slightly varying bands of silty clay (Figure 24a). Although some artifacts were recovered from this test unit (Table 34), no structural remains were found. Within the sediments encountered during excavation, a thin band of platy clay was recognized. This appears to be a water-formed stratum. It may have been created by the "drip line" from the roof of the structure immediately west of Test Unit 1. It could also be from puddled clay settling out at the bottom of vehicle ruts. It is unknown whether this band of clay could account for the resistivity feature detected by Geoscan.

Table 34. Artifacts from Test Units 1 and 2 at Site 14RY2171.

Provenience	Depth BS	Group	Item	Count
TU 1	00 to 10 cm	Activities	sheet metal	2
			carriage bolt	1
			iron chain	1
			metal fragment	1
		Architecture	composition shingle	2
			flat glass	3
			wire nail	4
		Kitchen	brown bottle glass	1
			clear bottle glass	5
			melted green bottle glass	1
			purple tinted bottle glass	1
			undecorated stoneware, manganese glaze	1
		Modern Military	artillery shell fragment	1
TU 1	10 to 20 cm	Activities	barbed wire	4
			brass object	1
			chain	1
			fencing staple	2
			square head machine bolt	1
		Architecture	flat glass	1
			wire nail	1
		Kitchen	brown bottle glass	1
			clear bottle glass	2
			light green bottle glass	1
		Modern Military	.50 cal. bullet	2
TU 1	20 to 30 cm	Architecture	wire nail	2
		Kitchen	light green bottle glass	1
			tin can fragments	7
TU 2	00 to 10 cm	Activities	cast iron fragment	1
		Architecture	flat glass	66
		Kitchen	clear bottle glass	2
			clear pressed glass	1
			dark green bottle glass	1
			exfoliated white porcelain	1
			glass canning jar lid insert	1
			purple tinted bottle glass	2
			semi-vitreous china	1
		Modern Military	.30 cal. bullet	1
			.50 cal. bullet	3
TU 2	10 to 20 cm	Architecture	flat glass	13
		Kitchen	clear bottle glass	3
			clear pressed glass	1
			semi-vitreous china	5
		Modern Military	.50 cal. bullet	2

Test Unit 2 was excavated over resistivity Feature G to a depth of 30 cm. Some artifacts were found in the upper 10 cm. Although no building remains were found, a concentration of window glass and several brick fragments noted in the wall of the test unit (Figure 24b) are consistent with the interpretation that resistivity Feature G may be related to building debris.

The artifact assemblage at 14RY2171 is consistent with the period of occupation indicated in the deed and tax records (the last quarter of the 19th century and the first half of the 20th century). The assemblage is dominated by architectural and activities materials that were probably spread over the site area as a result of intentional demolition. The amount of modern military artifacts, especially artillery shrapnel, indicates some disturbance to the original cultural level.

Of the farmstead sites tested, the results at 14RY2171 provide the best correspondence between the recovered archaeological data and the interpretation of the resistivity features. Test Unit 1 revealed a thin band of platy clay that was probably water-formed. At Test Unit 2, the predicted demolition debris was encountered. The results, however, are much more subtle and difficult to interpret than might be desired. While some form of water-related stratum was identified in Test Unit 1, this does not appear to be intentionally created. Although building debris was encountered in Test Unit 2, it is unclear how this material differs from other debris concentrations on the site that did not produce recognizable resistivity features.

Site 14RY2171 is the only one of the four tested farmsteads at which it seems questionable if sufficient data were gathered to make a recommendation concerning NRHP eligibility. The part of 14RY2171 south of the TCA has been heavily disturbed and cultural materials are very shallow. It is believed that additional testing should be carried out in the northern part of 14RY2171 in order to establish the distribution, age, and character of the subsurface deposits.

Army City, 14RY3183

Archaeological Investigations

Army City was a civilian operated entertainment center established in 1917 for troops stationed at Camp Funston (located immediately to the west of Army City) during World War I. A brief history of the site is presented in Chapter 4.

The Army City site was originally recorded during an inventory of historic period sites on Fort Riley (Halpin and Babson 1997). In 1996, preliminary geophysical

and archaeological investigations were carried out by Geoscan Research (USA) (Somers 1997) and the Public Service Archaeology Program (PSAP), University of Illinois at Urbana-Champaign (Kreisa and Walz 1997). Figure 25 shows the 1996 study area in relation to the site area gridded by LTA, Inc. in 1997.

The geophysical investigations in 1996 led to the discovery of resistivity and magnetic patterns interpreted to be cultural in origin:

> In the Higher Than Average map, a series of isolated high resistivity features which could be culturally interpreted as fill interior to former buildings or isolated high resistivity floors can be seen. In contrast, many of the strongest features in the Lower Than Average map have a high aspect ratio (long and thin) and tend to enclose the positive features. These could be culturally interpreted as former walls, footings, utility trenches, etc., which have been filled or back filled with clay rich soils and/or soils which contain more moisture than their immediate surroundings. . . .
>
> Both clusters of iron features suggest a NE - SW orientation with unambiguous orthogonal components. The orientation of features in the Iron Features map is the same as features found in the resistivity maps. . . .
>
> The All Low Level Data . . . maps and the Disturbed Soils maps . . . also contain historic occupation. It is characterized by the NNW - SSE orientation of linear features in the south half of the survey as well as a number of orthogonal features and linear features in the north half of the survey. . . .there seems to be more than one angular orientation present (Somers 1997:33, 34).

Archaeological testing in and around the geophysical features produced mixed results. Kreisa and Walz (1997:98) conclude that "[l]ittle of the archaeological data discussed above allow evaluation of the three potential research questions pertinent to 14RY3193 . . ." The following relationships were suggested between the geophysical and archaeological data:

> Speculatively, this difference [in the distribution of artifact groups] may indicate that the geophysical tests were locating architectural anomalies that did not contain many Kitchen group artifacts whereas the test units, located outside of the architectural features, may have been sampling refuse. In any case, this profile indicates that nondomestic activities dominated at Army City, a condition previously known from archival sources (Kreisa and Walz 1997:98).

The 1997 staking of Army City resulted in the grid pattern shown in Figure 25. Besides the main Army City site area north of the railroad tracks, an area to the south was also staked but not further investigated. This area is the dashed line grid on Figure 25 in the southeast corner of the map. Another area south of the railroad tracks, shown near the levee in the lowermost portion of Figure 25, was laid out by the Geoscan Research investigators and was ultimately tested by LTA.

Because of the findings from Geoscan Research's 1997 resistivity investigations, all LTA shovel tests and test units were excavated in the western part of Army City (Figure 26). The preliminary resistivity results indicated three clusters of features, two of them to the north of the railroad tracks and one to the south. In the discussions that follow, these areas are referred to as Area 1, Area 2 and the South Area (Figure 26). Descriptions of the resistivity features within these areas are presented in Tables 16–21. The approximate outlines of these features in relationship to the testing areas are shown in Figures 27 through 29.

Thirty-three shovel tests and nine test units were excavated in Areas 1 and 2. In these areas north of the railroad tracks, shovel tests were numbered consecutively. In general, the shovel tests were arranged to crosscut resistivity features and sample and compare areas inside and outside of them. In Area 1, Shovel Tests 1 and 2 explored the inside and outside of Feature A; Shovel Tests 3 through 8 were in a line perpendicular to and across Features L and M; Shovel Tests 9 and 10 were inside and outside of Feature B; Shovel Tests 11 through 16 were positioned diagonally across the "unknown region between linear features" (partially demarcated by Features Q and P); Shovel Tests 17 through 22 were intended to start on the outside and proceed into the interior of Feature D; Shovel Tests 23 through 25 were intended to do the same thing at Feature G; Shovel Tests 26 through 28 were intended to probe some of linear arrays of small resistivity areas described as Feature N (Figure 27).

The artifacts from the Area 1 shovel tests are summarized in Table 35. In addition to the items described in the table, massive pieces of concrete were encountered, but not collected, in Shovel Tests 7, 10, 11, 19, 21, 26, 27, and 28. The depth of the cultural materials was highly variable, with the basal depths of the positive shovel tests ranging from 20 to 60 cm. In general, Area 1 seems to contain a relatively uniform layer of artifacts in the upper 10 to 20 cm. If this layer can be penetrated, there is often another 10 to 20 cm that is relatively devoid of artifacts. Below this in many places within Area 1 is another zone of dense cultural material. The shovel test results in Area 1 indicate high artifact concentrations across much of this part of the site. There are no apparent correlations

between these densities and the locations of the shovel tests relative to the resistivity features (i.e., either within, outside, or on the edge of the features).

Seven test units were excavated within Area 1. The artifacts from these units are summarized in Table 36. Test Unit 1 was a 1x1-m unit at the corner of resistivity Feature O. Because of the amount of material found, this area was expanded by the excavation of another 1x1-m unit (Test Unit 5) immediately to the west.

Table 35. Artifacts from the Army City Area 1 shovel tests.

	ST6	ST12	ST14	ST15	ST16	ST17	ST18	ST20	ST22	ST23	ST24
Kitchen											
bottle cap	0	0	0	0	0	0	4	0	0	0	0
brown bottle glass	0	0	0	0	2	1	0	0	0	0	0
clear bottle glass	0	0	1	1	2	0	0	0	0	1	0
crown closure finish, light green glass	0	0	0	0	8	0	0	0	0	0	0
ironstone	0	0	0	0	0	1	0	0	0	0	0
light green bottle glass	0	0	0	2	53	0	0	0	0	0	0
milk glass	0	0	0	1	1	0	0	0	0	0	0
Architecture											
electrical ceramic	0	0	0	0	2	0	0	0	1	0	0
flat glass	1	0	0	3	4	0	0	0	16	0	0
glass block	0	0	0	3	0	0	0	0	3	0	0
melted lead	0	0	0	6	0	0	0	0	0	0	0
mortar/plaster	0	0	0	0	0	0	0	0	2	0	0
wire nail	0	0	0	1	5	1	0	1	11	0	2
Activities											
brass fragment	0	0	0	0	0	0	1	0	0	0	0
machine nut and bolt	0	0	0	0	0	0	0	0	1	0	0
Personal											
blue bottle glass	0	0	0	0	0	1	0	0	0	0	0
Other											
cinder/coal	0	8	1	0	4	0	0	0	4	0	5
melted glass	0	0	0	6	0	0	0	0	6	0	0

Table 36. Artifacts from test units in Army City Area 1, 14RY3193.

	TU1 20-30	TU1 30-40	TU5 00-10	TU5 10-20	TU5 20-30	TU5 30-40	TU2 00-10	TU2 10-20	TU2 20-30	TU2 30-40	TU2 40-50	TU3 00-10	TU3 10-20	TU3 30-40	TU3 40-50
Kitchen															
bone	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
brown bottle glass	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
clear bottle glass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	TU1 20-30	TU1 30-40	TU5 00-10	TU5 10-20	TU5 20-30	TU5 30-40	TU2 00-10	TU2 10-20	TU2 20-30	TU2 30-40	TU2 40-50	TU3 00-10	TU3 10-20	TU3 30-40	TU3 40-50
green bottle glass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
iron handle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ironstone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
purple tinted bottle glass	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
tin can	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Architecture															
brick	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
copper wire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
electrical ceramic	0	0	0	0	2	0	0	1	0	1	0	0	0	0	0
flat glass	0	0	4	5	0	1	0	2	0	3	0	0	0	0	0
gilded tag w/ large "12"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
glass block	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
mortar/plaster	0	0	0	0	0	0	0	0	0	0	0	0	0	21	1
porcelain fixture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
roofing nail	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
structural clay tile	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
stucco	0	0	0	0	0	0	0	1	0	0	0	1	0	0	6
tar paper	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
wire nail	61	35	0	1	14	8	0	22	23	18	1	1	1	0	0
wood	7	4	0	0	5	5	0	0	0	0	0	0	0	0	0
Activities															
carbon rod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cast iron	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
iron rod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
melted copper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
metal strapping w/ wire nails	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sheet metal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
slotted metal rod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Personal															
metal token?	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
prescription oval base, clear	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
Clothing															
1909 bronze collar disk,	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	TU1 20-30	TU1 30-40	TU5 00-10	TU5 10-20	TU5 20-30	TU5 30-40	TU2 00-10	TU2 10-20	TU2 20-30	TU2 30-40	TU2 40-50	TU3 00-10	TU3 10-20	TU3 30-40	TU3 40-50
screw back															
copper rivet	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Furniture															
cast iron ornament	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other															
burned wood/ charcoal	0	0	0	13	0	0	0	0	0	0	1	0	0	0	2
cinder/coal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
melted glass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: Column headings indicate test unit and depth below surface (cm).

Table 36. (cont.)

	TU9 00-10	TU9 10-20	TU9 20-30	TU4 00-10	TU4 10-20	TU4 20-30	TU4 30-40	TU4 40-50	TU4 50-60	TU4 60-70	TU4 70-80	TU4 80-90	TU4 90-100
Kitchen													
bone	0	0	0	0	0	0	0	0	0	0	0	0	0
brown bottle glass	0	0	0	0	0	0	0	0	1	0	0	0	0
clear bottle glass	0	0	0	1	0	0	0	0	1	1	0	0	0
green bottle glass	0	0	0	0	0	0	0	1	0	0	0	0	0
iron handle	0	0	0	0	1	0	0	0	0	0	0	0	0
ironstone	0	0	0	0	1	0	0	0	0	0	0	0	0
purple tinted bottle glass	0	0	0	0	0	0	0	0	0	0	0	0	0
tin can	0	0	0	0	0	0	0	0	0	4	0	0	0
Architecture													
brick	0	0	0	0	0	0	0	0	0	0	0	0	0
copper wire	0	0	0	0	0	0	0	0	0	1	0	0	0
electrical ceramic	0	0	0	0	1	0	0	0	0	0	0	0	0
flat glass	2	4	1	3	0	0	0	2	3	0	1	1	0
gilded tag w/ large "12"	0	0	0	0	0	0	0	0	0	0	0	0	0
glass block	0	0	0	0	0	0	0	0	1	0	1	0	0
mortar/plaster	0	0	0	0	0	0	0	0	0	0	5	1	0
porcelain fixture	0	0	0	0	0	0	0	0	0	0	1	0	0
roofing nail	0	0	0	0	0	0	0	0	0	0	0	0	0
structural clay tile	0	0	0	0	4	0	0	1	6	6	5	5	0
stucco	0	0	0	0	0	1	15	2	0	0	0	0	1
tar paper	0	0	0	0	0	0	0	0	0	1	1	0	0
wire nail	0	0	0	0	0	0	0	1	7	46	7	10	8
wood	0	0	0	0	0	0	0	0	0	0	0	0	0
Activities													
carbon rod	0	1	0	0	0	0	0	0	0	0	0	0	0
cast iron	0	0	0	0	0	0	0	0	0	0	0	0	0
iron rod	0	2	0	0	0	0	0	0	0	0	0	0	0

	TU9 00-10	TU9 10-20	TU9 20-30	TU4 00-10	TU4 10-20	TU4 20-30	TU4 30-40	TU4 40-50	TU4 50-60	TU4 60-70	TU4 70-80	TU4 80-90	TU4 90-100
melted copper	0	2	0	0	0	0	0	0	0	0	0	0	0
metal strapping w/ wire nails	0	0	0	0	0	0	0	1	0	0	0	0	0
sheet metal	0	0	0	0	0	0	0	0	0	0	0	0	0
slotted metal rod	0	0	0	0	0	0	0	0	0	0	0	0	0
Personal													
metal token?	0	0	0	0	0	0	0	0	0	0	0	0	0
prescription oval base, clear	0	0	0	0	0	0	0	0	0	0	0	0	0
Clothing													
1909 bronze collar disk, screw back	0	0	0	0	0	0	0	0	0	0	0	0	0
copper rivet	0	0	0	0	0	0	0	0	0	0	0	0	0
Furniture													
cast iron ornament	0	1	0	0	0	0	0	0	0	0	0	0	0
Other													
burned wood/charcoal	0	0	0	0	0	0	0	0	0	0	4	5	10
cinder/coal	0	0	0	0	0	1	0	0	0	0	0	0	0
melted glass	0	3	0	0	0	0	0	0	0	0	0	0	0

Note: Column headings indicate Test Unit and depth below surface (cm).

Artifacts in Test Units 1 and 5 started near the present ground surface and extended to approximately 40 cm. Large pieces of concrete (not collected), wire nails and thin pieces of dimensional lumber were the most common types of cultural material encountered. The nails recovered tended to be extremely deteriorated and the soil matrix throughout the two units contained a great deal of charcoal staining. Both of these characteristics tend to suggest that the area was intensively burned.

Near the east edge of Unit 5, several very large pieces of broken concrete were unearthed (Plate 1a*). When these materials were removed, an in-situ concrete footing was found within a builder's trench. Once this area had been cleaned off, it was possible to refit the broken concrete on top of the footing (Plate 1b), demonstrating that all of this material was once part of a grade-beam footing and

* Plates are placed at the end of the report (following the figures).

foundation wall. These same items can be seen in the floor plan and wall profile presented in Figure 30.

Test Unit 2 was a 0.25x4-m unit extending from the east edge into the interior of Feature F. To enter the feature at a right angle, the 4-m long walls of Test Unit 2 were oriented 44 degrees west of north. Although artifacts from this test unit are shown in Table 36 at depths varying from 10 to 50 cm, most of this material appears to have come from a thin cultural level recognizable 10 to 25 cm below the present ground surface (Figure 31). The differing artifact depths in Table 36 are mainly reflective of the south to north downslope in both the cultural level and the present ground surface.

Although some charcoal flecking was evident, it was not as obvious in Test Unit 2 as it was in Units 1 and 5. Massive pieces of construction debris were also not encountered. Wire nails and fragments of stucco (not all of which were collected) are the primary artifact types found in Test Unit 2.

Test Unit 3 was a 0.5x2-m unit excavated over the outside edge of an unlettered resistivity anomaly west of Feature G. This area of excavation was extended further north by another 0.5x2-m unit (Test Unit 9). Although excavated to 50 cm, these test units produced only a small amount of very dispersed cultural material, mostly small fragments of window glass, mortar, and plaster. A consolidated cultural level was not identifiable.

Test Unit 4 was a 1x1-m unit positioned near the center of Feature E. The unit proved to be within a dense concentration of construction/demolition debris (Plate 2a) that extends to below 100 cm (the depth at which excavations stopped). These materials consist primarily of wire nails, large pieces of stucco, fragments of structural clay tile, and fragments of poured concrete with an impressed surface design that forms a pattern of 6-in. (15.24-cm) squares. Because of the bulky nature of this material, much of it was not collected. As with Test Units 1 and 5, the nails from Test Unit 4 appear to be burned, and the soil matrix contained extensive charcoal staining.

Test Unit 6 was a 1x1-m unit excavated in the interior areas of Feature O. The unit was excavated to 50 cm. The most time-diagnostic artifact of the excavations was found in the upper 10 cm of this unit. This artifact is a 1 and 1/4 in. bronze collar disc with a raised "US" over a lined background. Two small prongs and a broken-off center stud on the back of the artifact indicate that it had a screw attachment. Insignia of this type were first issued in 1908 and were in use on olive drab service coats to at least 1917 (Bruun 1981).

A piece of 4.5-in. (11.4-cm) cast iron sewer pipe was also encountered within Test Unit 6. The pipe extended approximately east to west through the northern part of the unit (Plate 2b). Although initially thought to be in place, the profile of the east wall of the test unit showed it to be on top of charcoal and concrete debris in an irregularly shaped and disturbed stratum (Figure 32). Probing east of Test Unit 6 revealed the broken end of the same pipe. It is therefore believed that the pipe is out of place and part of a stratum of demolition debris. The soil matrix throughout the lower 40 cm of excavation within Test Unit 6 was heavily mixed with charcoal staining.

Five shovel tests and two test units were excavated in Area 2 (Figure 28). The artifacts from this part of the site are summarized in Table 37. Shovel Test 29 was excavated near the center of resistivity Feature J; Shovel Tests 30 through 33 were excavated along an east-west line within and outside of Features I and K. Besides the artifacts from shovel testing itemized in Table 37, massive pieces of concrete or limestone were encountered, but not collected, in Shovel Tests 32 and 33. In most of the shovel tests in Area 2, the artifacts that were recovered tended to come from the upper 10 to 20 cm. Below this, an impenetrable zone of building material was encountered.

Test Unit 7 was a 1x1-m unit excavated in the interior of Feature H. Although the unit was excavated to 70 cm, very few artifacts were recovered. Below approximately 10 cm of modern top soil, the remainder of the sediment appears to be a uniform zone of silty clay. A large piece of concrete, taking up much of the floor of the unit, was unearthed between 30 and 46 cm.

Test Unit 8 was a 1x1-m unit placed near the northwest corner of resistivity Feature H. To be at right angles to the feature, the walls of the test unit were rotated 45 degrees from grid north. Except for a concentration of wire nails in the 10- to 20-cm level, very few artifacts were recovered. The most important finding from Test Unit 8 was a large block of shaped limestone, probably a building footing, exposed in the northwest wall (Plate 3a).

Area 2 contains evidence of a prehistoric component. These materials consist of Florence chert flakes, two from Test Unit 7 and one from Test Unit 8. The flakes appear to have been distributed within the same matrix containing the historic artifacts.

The South Area is a 40x40-m resistivity sample area south of the Union Pacific railroad tracks. Besides identified resistivity features A through F, three small concrete footings are visible on the surface and a concrete foundation was found

in probing immediately below the sod level (see Figure 29). The southwest corner of the area is covered by a low mound of dirt.

Eleven shovel tests were excavated within the resistivity features. To distinguish these tests from those in Areas 1 and 2, they were lettered the same as the feature being investigated. The shovel tests indicate a matrix of silty clay transitioning to sandier materials between 30 and 50 cm. Artifacts were found down to the base of the silty clay but did not appear to continue into the sandy deposits. The artifacts recovered from the South Area are summarized in Table 38. Besides the artifacts listed in Table 38, massive pieces of concrete were encountered, but not collected, in Shovel Tests A', B3 and B4.

Table 37. Artifacts from Army City Area 2 shovel tests and test units.

	ST29	ST30	ST31	TU7 00-10	TU7 10-20	TU7 30-40	TU7 40-50	TU7 50-60	TU7 60-70	TU8 00-10	TU8 10-20
Kitchen											
brown bottle glass	0	0	0	0	0	0	0	0	0	2	0
clear bottle glass	0	0	0	0	0	0	0	0	1	0	1
ironstone	0	0	1	0	0	0	1	0	1	0	0
peach pit	0	0	0	0	0	0	0	0	0	2	0
semi-vitreous china	0	0	0	0	0	0	0	0	0	2	1
Architecture											
electrical ceramic	0	0	0	0	0	0	0	0	0	0	1
flat glass	0	1	0	1	0	0	0	0	2	3	2
roofing nail	0	1	0	0	0	0	0	0	0	0	1
spike	0	0	0	0	0	1	0	0	0	0	0
stove pipe	0	0	0	0	0	0	0	0	3	0	0
stucco	0	0	0	0	0	0	0	3	0	0	3
wire nail	0	0	0	0	0	0	0	1	0	4	44
Activities											
1-1/4 in. dia. flat washer	0	0	0	0	0	0	0	0	1	0	0
sheet metal	0	0	0	0	0	0	0	1	0	0	2
slotted metal rod	0	0	0	0	0	0	0	0	0	0	1
staple	0	0	0	0	0	0	0	0	0	1	0
Arms											
.22 cal. short case w/ "H" headstamp	0	0	0	0	0	0	0	0	0	1	0
Personal											
1913D penny	0	0	0	0	0	0	0	0	0	1	0
Goodyear comb tooth	1	0	0	0	0	0	0	0	0	0	0
prescription base & finish, clear	0	0	0	0	0	0	0	0	0	4	0
Prehistoric											
chert flake	0	0	0	0	1	1	0	0	0	1	0

Note: ST=Shovel Test, column headings indicate Test Unit and depth below surface (cm).

Table 38. Artifacts from the South Area, Army City, 14RY3193.

	ST A	ST B5	ST D	ST E	TU 10 00-10	TU 10 10-20	TU 10 20-30	TU 10 30-40	TU 10 40-50
Kitchen									
bone	0	0	0	1	0	4	13	0	0
clear bottle glass	1	0	0	0	0	0	0	0	0
Architecture									
roof. nail	1	0	0	0	0	0	2	2	1
tar paper	0	0	0	0	0	0	0	6	0
wire nail	0	2	1	3	3	10	15	38	5
Activities									
barbed wire	0	0	0	0	1	0	0	0	0
copper frag	0	0	0	0	0	0	0	0	0
iron frag	0	0	0	0	0	0	0	0	0
Personal									
tobacco can	0	0	0	0	0	20	4	4	0
Other									
cinder/coal	2	1	0	0	0	0	0	0	0
melted glass	0	0	0	0	0	0	0	0	0
Prehistoric									
chert flake	0	0	0	0	0	0	1	0	0

The final test unit excavated at Army City, Test Unit 10, was a 1x1-m unit placed along the south side of one of the concrete footings. This position also put the unit near the center of resistivity Feature E. Test Unit 10 was excavated to 60 cm. Saw-cut bone, wire nails, and dispersed fragments of a single tobacco can make up the bulk of the artifacts from the unit. Most of the faunal remains are much less fragmented than the small amounts found in Area One. It has been identified as various rib elements from domestic cattle (Bos sp.). One flake of Florence chert was found in the assemblage.

The poured concrete footing along the north wall of Test Unit 10 proved to have a substantial subsurface component (Plate 3b). The base of the footing appears to have been significantly widened. This component is probably the remains of a crudely poured spread foundation with a stepped footing. Spread foundations are often used to bear the weight of large girders or roof trusses (Watson 1986:37).

The soil profile revealed in Test Unit 10 is essentially the same as found in the shovel tests. Except for a thin layer of modern sod, the upper 40 to 45 cm consist of an undifferentiated silty clay. Below this layer is a sand clay of unknown

depth. Except for the base of the concrete footing, which extends approximately 6 cm into the sandy clay, all of the artifacts were found in the silty clay stratum.

Interpretations and Site Significance

The 1997 archaeological investigations at Army City have revealed important information concerning site integrity and spatial patterning. From the standpoint of testing resistivity features, the shovel tests did not prove to be a good interpretive tool. This is not because they did not produce results but, quite to the contrary, because so many of them produced cultural material. No clear feature vs. nonfeature distinction in artifact frequency, artifact types, artifact depth, or sediment characteristics could be detected in shovel test data.

The test units excavated at Army City revealed the following:

1. Test units placed within or over anomaly images with strong linear patterns (straight lines, right angle corners, multiple, aligned box-like features) tended to produce evidence of structural patterning and demolition debris consistent with maps and other historical documentation on the site. The most striking examples of this patterning are the findings from Test Units 1 and 5 in Area 1.

2. Resistivity features having a more broken, but still clearly linear, pattern appear to be the result of partial foundations or rows of isolated footings. This pattern can be seen in the limestone footing in Test Unit 8 of Area 2 and the large but isolated concrete footing in the South Area.

3. Test units placed along the edges of resistivity images with a rounded or oval appearance generally tended to produce only materials from what is interpreted to be the general scatter of debris at the site. These locations produced very little in the way of identifiable building remains, which was the case in the Test Unit 2 and Test Unit 3/9 areas (both in Area 1) and at Test Unit 7 in Area 2.

4. Excavation near the center of one of the rounded images mentioned in #3 produced dense concentrations of unpatterned building debris and charcoal. The only example of this is Test Unit 4 in Area 1, where a meter of massive rubble deposits was unearthed.

Besides investigating the resistivity features, the excavations have also produced other types of information. As noted in the discussions, Test Units 1, 3–6, and 9 all appear to be in areas of intensive burning. Based on the amounts of building

rubble found in some of the test units, it also appears that extensive demolition took place in this part of the site. Some charcoal staining was also evident in the other areas of testing, but it appears to drop off significantly in Test Unit 2 and the other excavations further to the south.

Because of this pattern, an attempt was made to explain the findings in relationship to the maps and the historical information presented in Rion (1960). In viewing the outlines of the resistivity features in Area 1, a gap is noticeable between Features O and G. At right angles to this is another wide area containing only the short N features (see Figure 27). These gaps are approximately 14-m (60-ft) wide, indicating they are the 60-ft wide streets described by Rion (1960:18). Using this information and the burning data from the above referenced test units, it appears that the street intersection indicated in the resistivity image is the intersection of General Street with Washington Avenue. Blocks 4 and 5, those that burned in the 1920 fire (Rion 1960:41), would be to the north of General Street, separated from each other by Washington Avenue. Figure 33 is a computer-aided design (CAD) image of the 1917 map, overlaid on the 1997 site map. Scaled and rotated to match the 60-ft street width in the resistivity pattern, the building locations in the 1917 map match very well with resistivity features and some surface patterning.

The 1920 fire is described as having started in an apartment in the Hippodrome Theater building in the southwest corner of Block 5 (Rion 1960:80,81). The lack of resistivity features and artifacts in what was platted as the western 1/3 of Blocks 5, 6, and 15 suggests that these areas may never have been developed and that these three blocks along the west side of town were actually narrower than platted. If this is the case, resistivity features C, D, E, and O are almost certainly the Hippodrome Theater building. Many of the shops known to have burned in the fire — the Dillner Photo Shop, the Haarmyer News and Tobacco Store, the Davis Tailor Shop, the Mason Cafe, and the O. B. Scott Variety Store — were likely part of the small partitioned areas around the south and east sides of the Hippodrome (see Plate XII, Figure 1 in Rion 1960). The Ziegler-Dalton building, which also burned, is known to have been in Lots 1, 2, and 3 of Block 5 and its position can also be seen on Figure 33.

Based on a photo of standing and destroyed buildings in Rion (1960:Plate XI, Figure 2), the Orpheum Theater appears to have been in the southwest corner of Block 4. This evidence would place the building across Washington Avenue from the Hippodrome and match with resistivity Feature G.

South of General Street, resistivity Features F and H match well with two buildings shown on the 1917 map in Block 6. Across Washington Avenue, along

the west side of Block 7, a distribution of surface masonry matches quite well with the plotted position of another building on the 1917 map. South of Block 6, and across Colonel Street, another building location in Block 15 matches very well with Features I and J. None of the features south of General Street burned (Rion 1960:81).

Either because of original errors, distortion in the printing of the 1917 map, or errors in field mapping (probably a combination of all three factors), there is increasing divergence in the 1917 map and the resistivity and archaeological features as one goes farther south on Figure 33. Because of this, the two buildings shown on the 1917 map south of the railroad tracks are projected on top of, or just north of, the tracks in Figure 33. In the figure, dashed lines have been used to predict the actual locations of these two buildings, one over the building remains found in the South Area, the other under a linear growth of trees in the southeastern part of the site.

As a means of testing the potential accuracy of the 1917 map projection on Figure 33, the geophysical features identified in 1996 were compared to the buildings shown in the eastern part of the site. While some west to east distortion in the image is likely, there are near matches with the buildings on the map and the building corners and other linear patterns detectable in the 1996 geophysical results (e.g., Somers 1997:Figures 4-B, 4-C, 4F, and 4G).

With this information in hand, a clearer picture of the site is possible. The 1996 investigations (Somers 1997; Kreisa and Walz 1997) tested an area east of the main business district that may have been, based on Rion's descriptions, primarily residential. The location of Watson's Cleaning Plant, the last standing building at Army City, is just outside of the north end of the 1996 study area.

With the exception of Test Unit 2 and the shovel tests surrounding it, nearly all of the work done in Area 1 is within Blocks 4 and 5, the area that burned in the 1920 fire. The massive pieces of structural debris and concentrations of charcoal are the remains of the buildings burned in place and, after the fire, intentionally leveled. Stucco, red clay structural tiles, and concrete impressed to resemble 6x6-in. ceramic tiles all attest to the Mission Style theme in the business district. As noted earlier, a combination of historic documents, resistivity features and archaeological data makes it possible to determine the location of certain named businesses that are known to have existed within Area 1.

The definition of building and block locations also helps explain some of the findings from testing. As illustrated in Figure 30, the foundation wall found in Test Unit 5 is at an approximate 45 degree angle with the north edge of Feature

O, now believed to be the Washington Avenue side of Block 5. At first this seems to conflict with both the resistivity pattern and the proposed street plan. In viewing the photographs presented in Rion (e.g., Rion 1960:Plate XI, Figure 3), however, it is apparent that building entrances at the corners of blocks within the business district were constructed at 45 degree angles to the street corners. The entrance to the Apollo Theater, as shown in Rion (1960:Plate XII, Figure 1) clearly reflects this pattern and may, in fact, be the location explored with Test Units 1 and 5.

From Test Unit 2 and south into Area 2, the 1997 studies were still in the business district along Washington Avenue. This part of the district, however, was not burned. Once the site area was abandoned, these buildings were sold and either moved off the property or scrapped (Rion 1960:82). Unlike Blocks 4 and 5, the archaeological record from this part of the site is probably reflective of the site's short-term use followed by the accumulation of a small amount of debris from the dismantling and moving activities.

Construction techniques in the areas on south Washington Avenue also appear to have been somewhat different. In contrast to the massive grade-beam foundation found under the Apollo Theater, individual limestone block footings may have been used to support the buildings in this part of the site.

The South Area investigated in 1997 clearly contains the remains of a large building. Whether or not this is part of the segregated Army City South is unclear. As shown on the 1917 map (see Figure 14), this building is actually between a "Y" in the railroad tracks. Rather than being part of Army City South, such a position likely suggests that the building functioned as a warehouse or some other type of facility related to its proximity to the tracks. The large stepped footing exposed in the north wall of Test Unit 10 also suggests some type of commercial building with substantial roof trusses.

Differences are subtle in the artifact assemblages recovered from the three areas tested. In Area 1, as already mentioned, a great deal of demolition debris was encountered. Within and below this cap of architectural material is a light to medium distribution of "kitchen" artifacts, personal items, and clothing that relate to the functioning of the business district before the fire.

The Area 2 artifacts, while still containing a high proportion of architectural material, seem to be more reflective of the day-to-day activities at the site. Although only 2 m^2 of testing was done in Area 2, bottle glass, ceramics and various personal items appear to be fairly common.

The South Area artifact assemblage, although probably undersampled, is quite interesting. Either because of preservation or functional differences, the faunal assemblage in this part of the site is both larger and more identifiable than in Areas 1 and 2. Within the south area, indications of electrical wiring (electrical ceramics) and windows (flat glass) were not recovered. All of the architectural items found relate to either roofing (roofing nails and tar paper) or wood framing (common wire nails); there are no indications of the stucco covering found in Areas 1 and 2.

The materials recovered from the 1997 archaeological testing at Army City indicate a well-preserved artifact assemblage consistent with the known age, function, and destruction patterns at the site. In addition to individual artifacts, there are in situ structural remains present that substantially match the building layout shown on the 1917 map of the site. With only a small amount of additional archival research, it is believed possible to identify individual shop areas, at least within the Hippodrome complex.

The three areas tested in 1997 further indicate that various parts of the site produce distinctively different artifact assemblages. Although probably influenced by differential preservation, there are strong indicators that these differences are primarily the result of functional patterning.

As far as is presently known, Army City is the only area in the United States where a planned community was erected specifically for the purpose of providing entertainment and services to World War I soldiers. Due to the town's rapid demise in the early 1920's, the site contains a very concise and time-specific record of this event. Because of the site's history and archaeological contents, it is believed that Army City is eligible for nomination to the NRHP under Criteria A and D.

Conclusions

Addressing the Research Questions

This section returns to the research questions posed in Chapter 4 and, based mainly on the results from archaeological testing, attempts to answer them. While reading the interpretations presented below, it is important to keep in mind both the limited nature of the archaeological testing conducted and the dual objectives of the investigations (i.e., ground truthing selected geophysical features and assessing the NRHP eligibility status of the sites).

Farmsteads and Army City

a. At a given resistivity feature, are there any characteristics found in the archaeological record that might explain or aid in defining what the feature is?

Taking the results from Army City and the four farmsteads together, archaeological results, often combined with historic sources, appear to have supplied pertinent information regarding the origin of the resistivity features approximately 60 percent of the time. The preponderance of these "positive" results, however, came from Army City. The characteristics revealed vary from subtle changes in soil characteristics to aligned building foundations.

b. If such characteristics are detected, do they indicate that the feature is a result of natural forces, historic occupation, post-occupation disturbances, or some combination of all three factors?

The characteristics detected appear to be about evenly split between those resulting from the historic occupation and those from post-occupation disturbances, the latter being primarily military training activities. In most cases, the guidance provided by the geophysical investigator effectively steered the archaeological investigations away from features created by natural forces.

c. Do the locations of resistivity features serve to indirectly indicate the location of artifact concentrations or other important archaeological data that do not themselves create a resistivity signature?

This relationship only seems to be the case in unique settings such as the burned and razed Blocks 4 and 5 at Army City, where dense artifact concentrations are present around building foundations and within excavated depressions. In other cases, such as at 14RY2118, artifactual patterning seems to have very little relationship to the location of resistivity features. During the farmstead investigations in general, shovel test results along the site grid systems (a near-random sample) tended to produce more artifacts than the shovel tests at or across resistivity features.

d. Are certain resistivity feature shapes and/or sizes more archaeologically productive than others?

Well-defined linear patterns containing clear right angle edges were the most productive feature types investigated.

e. What is the best means of testing resistivity features?

It is believed that, when possible, at least 2 m^2 of excavation should be devoted to investigating a particular resistivity feature. Shovel testing appears to be a very ineffective investigation technique.

Questions Specific to the Farmsteads

f. Within the distribution of artifacts over the site area, are there patterns indicative of definable activity areas?

Well-preserved sites such as 14RY2118 appear to produce artifact patterns associated with definable activity areas. This association is not the case in areas that have been disturbed by military training activities.

g. If midden or dump areas are present, can they be functionally and/or spatially linked to other observable site features?

At the farmstead sites tested in 1997, except in very general ways (e.g., within the site's previously defined boundaries), midden and dump areas do not appear to be linked to building locations.

h. Does the artifact assemblage indicate occupational patterns that are not obvious in the historical documents?

At well-preserved sites such as 14RY2118, the artifact assemblage seems to both confirm the known sequence of historic occupation and add details concerning site function that are not available from archival sources. At disturbed sites such as 14RY152 and 14RY2170, archaeological testing results tend to be much less informative than what can be learned from a combination of historic research and the careful recording of surface evidence.

i. Are curated items present that might indicate the ethnic ties or the geographic origin of the original occupants of the farmstead?

The testing has demonstrated that curated items are present at farmstead sites. When they can be recovered in a good context, these items should provide clues to the ethnic and geographic ties alluded to in the above question. To be meaningful, however, much larger excavations would have to be undertaken within the framework of a well-developed research design.

Questions Specific to Army City

Babson (1997) and Kreisa and Walz (1997:99) identified three areas of research that appear to be central to an evaluation of the significance of the Army City site:

1. The investigation of civilian-military interaction at Fort Riley.

2. The impact of World War I on Fort Riley.

3. The investigation of racial segregation at the site and whether or not the segregated facilities were "separate but equal."

These three research domains, although valid, cannot be adequately addressed by the types and levels of investigations carried out at Army City to date. Archaeology, archival source material, oral histories, and even historical fiction of the era will all have a part to play in developing a more concise understanding of these complex social interactions. The 1997 investigations at Army City have demonstrated that the site contains a well-patterned assemblage of material culture items. How these materials will be woven into the "story telling" (e.g., Praetzellis 1998) of the site's history will depend on the inclinations and ingenuity of future investigators.

Rion's (1960) study represents the most comprehensive history of the Army City site. His study provides information about the location of commercial, residential, and African American portions of the site, and provides a basis for defining a number of general research questions.

j. Are there archaeological remains at the historically documented locations?

The LTA testing at Army City demonstrated that, at least within certain parts of the site, there is a good correlation between the subsurface remains and the documented locations of buildings and streets. This finding contrasts with the results of the 1996 investigations by PSAP (Kresia and Waltz 1997). The differences in results between the 2 years of study are probably due to the fact that much of the LTA study was within or near the "heart" of Army City where building distributions are historically better documented, buildings appear to have been more substantial, and human activity was probably the most intense. The PSAP investigations, on the other hand, were on the eastern "fringe" of the community.

k. Are structural remains present that would correspond to the 1917 map, historic photographs, and available descriptions of the site?

Structural remains are present that correspond to specific buildings on the historic map. Archaeological and geophysical results, however, tend to produce much more accurate data on building placement, size, and shape than is available from the map.

l. Are there detectable differences in the artifact assemblages from the three areas that would bolster the idea that each served a separate function?

There are detectable differences in the artifact assemblages from the three areas tested at Army City (Area 1, Area 2, and the South Area). These differences are believed to be due to both preservation patterns and functions and activities specific to the various areas investigated. It should be pointed out that the testing in the South Area is not believed to have identified the segregated African American entertainment area. Instead, it appears that work in the South Area encountered a structure associated with the railroad.

m. Can the burned area of Army City (Blocks 4 and 5) be detected, and is its artifact assemblage different from that of the unburned portions of the commercial district?

The burned area is very obvious in the archaeological findings. For several reasons discussed earlier, the artifact assemblage in this part of the site does appear to be different from other parts of the business district.

National Register Eligibility

14GE1108

No archaeological testing has been carried out at this site. Military impacts to 14GE1108 appear to be minimal. The site's original spatial patterning and building layout are intact. This farm site also seems to have been occupied relatively early for this part of Kansas (probably ca. 1869). Additional archaeological testing is recommended at 14GE1108 to determine the site's eligibility under NRHP Criterion D.

14RY152

Following testing at this site, Halpin (1997:83) concluded that 14RY152 was not eligible for nomination to the NRHP. That assessment was based on the fact that the site has been severely impacted by military training. The results of the 1997 LTA testing confirm Halpin's assessment. The artifact assemblage is contained within a thin and eroded stratum near the surface. Post occupational activities have disturbed and mixed the cultural level. Because of this lack of physical integrity, 14RY152 is not believed to be eligible for nomination to the NRHP.

14RY2118

This site, the Herman Mann homestead, consists of a large barn and corral area, a probable house location, a rock-lined cellar, and the disturbed remains of a probable cistern. The 1997 testing results indicate thin but well stratified subsurface cultural deposits. Two periods are indicated in the artifact assemblage — one from Mann's period of ownership (ca. 1862 to 1882), the other from the 1880's through the 1920's.

It is believed that 14RY2118 is eligible for nomination to the NRHP under Criterion D. This finding is due to the site's early age (ca. 1868), the integrity and complexity of the building remains, and the presence of an artifact assemblage reflective of the site's age and function. Military use of the area has had very little impact on the site.

14RY2170

The county records indicate that this site was probably first occupied ca. 1891. This is consistent with the archaeological assemblage and building features. Nearly all of the artifacts at 14RY2170 appear to be from a thin stratum near the present ground surface. These deposits have been extensively disturbed by military training activities. Site 14RY2170 is not believed eligible for nomination to the NRHP. This finding is due to the site's lack of physical integrity and considerable disturbance to its original setting.

14RY2171

Tax records indicate that this site may have been occupied as early as 1885. The artifact assemblage at 14RY2171 is consistent with this assessment. The assemblage is dominated by architectural materials, much of which was spread

over the site area as a result of intentional demolition. The number of modern military artifacts indicates some disturbance to the original cultural level.

It is not believed that sufficient data were collected to assess this site's eligibility for nomination to the NRHP. The portion of the site south of the tactical concealment area has a very thin cultural level that has been extensively disturbed by military training activities. To the north of the tactical concealment area, more of the original site appears to have been left intact. It is recommended that additional archaeological testing should be carried out in the northern part of 14RY2171 in order to establish the distribution, age, and character of the subsurface deposits.

14RY3193, Army City

Nearly all of the work done in Area 1 at Army City is within Blocks 4 and 5, the area burned in the 1920 fire. The massive pieces of structural debris and concentrations of charcoal are the remains of the buildings burned in place and intentionally leveled. The building materials recovered in Area 1 confirm the Mission Style theme in the business district. A combination of historic documents, resistivity features and archaeological data makes it possible to determine the location of certain named businesses within Area 1.

Unlike Blocks 4 and 5, the archaeological record south of Washington Avenue is reflective of the site's short-term use followed by the accumulation of a small amount of debris from dismantling and moving activities. Construction techniques in this part of the site were also different. In contrast to the massive grade-beam foundation found under the Apollo Theater, individual limestone block footings may have been used to support the buildings.

The South Area investigated in 1997 contains the remains of a large building. Rather than Army City South (the segregated entertainment area), the position and structural character of this building suggests that it functioned as a warehouse or some other type of industrial facility related to the railroad tracks.

The materials recovered from the 1997 archaeological testing at Army City indicate a well-preserved artifact assemblage consistent with the known age, function, and destruction/demolition patterns at the site. The structural remains unearthed in testing substantially match the building layout shown on the 1917 map of the site.

The three areas tested in 1997 demonstrate that various parts of the site produce distinctively different artifact assemblages. Although probably influenced

by differential preservation, there are strong indicators that these differences are primarily the result of functional patterning.

As far as is presently known, Army City is the only area in the United States where a planned community was erected specifically for the purpose of providing entertainment and services to World War I soldiers. As a result of the town's rapid demise in the early 1920's, Army City contains a very concise and time-specific record of this event. Because of the site's history and archaeological contents, 14RY3193 is believed to be eligible for nomination to the NRHP under Criteria A and D.

6 Synthesis of Results

by

Michael L. Hargrave

Introduction

The project described in this report had two primary objectives: (1) to evaluate the NRHP eligibility status of five historic period archaeological sites at Fort Riley and (2) to evaluate the role of geophysical survey techniques (particularly resistivity) in archaeological site assessment. This project represents one component of CERL's systematic effort to develop a cost-effective and reliable strategy for NRHP eligibility assessments based on the use of geophysical techniques and targeted ground-truthing techniques. Fort Riley has been an important partner in this effort, providing the opportunity for an initial test of the approach in 1996 (Hargrave 1998), and a second season of work in 1997 (reported here).

Geophysical and archaeological investigations were conducted in 1997 at five late 19th-early 20th century farmsteads (14GE1108, 14RY152, 14RY2118, 14RY2170, and 14RY2171) and a World War I era entertainment complex (Army City, 14RY3193). (Site 14GE1108 served as an alternate site, and no archaeological excavations were conducted there.) This report includes slightly revised versions of the final reports of investigations submitted by Somers (1998) and Larson and Penny (1998). Chapters 3 and 5 of this report provide the full statements of findings and conclusions for the geophysical and archaeological investigations, respectively. This chapter reviews and synthesizes project results with an emphasis on methodological issues. It concludes with recommendations for future geophysical work at Fort Riley.

Army City

The large-scale geophysical survey of Army City (14RY3193) was highly successful. Most (92,400 m^2) of the site was surveyed. The only portions omitted were the areas to the extreme southeast (south of the railroad tracks) and extreme east (east of the E Street Extension Road). When the geophysical and archaeological fieldwork was underway, it was believed that the southernmost part of

the site (located south of the railroad track) contained the African American area. It was eventually determined that the South Area contains a building related to the railroad, and that the African American area is farther east. Completion of a geophysical survey in the southeastern area remains an important goal for future work.

The westernmost portions of Army City, referred to here as Areas 1 and 2, contain the commercial district. This area contained the large theater complexes as well as a number of stores and other business establishments. In a commercial sense, this area was the heart of Army City. Somer's interpretation of the 1997 geophysical survey results focused on Areas 1 and 2 and the South Area. Larson's excavations focused on the same areas. A relatively small portion of eastern Army City was examined in the 1996 fieldwork (Hargrave 1998; Kreisa and Walz 1997; Somers 1997).

In Areas 1 and 2 Somers designated and interpreted a number of geophysical features. Each feature represents a geophysical anomaly, that is, a discrete area characterized by resistivity values distinct from those of surrounding areas. Most of these geophysical features are larger and more internally complex than would be the features defined by an archaeologist excavating the site. For example, Feature O was interpreted by Somers as a group of connected buildings, probably small stores located within the greater Hippodrome Theater complex. If Feature O was thoroughly excavated, it would undoubtedly be subdivided into a large number of archaeological features. This observation is not intended as a criticism of the approach adopted by Somers. Features are simply analytical units defined for particular purposes and, in the geophysical study, the objective was to provide a very generalized description of geophysical features that appear to correspond to important archaeological deposits. It is important to note that, if Somer's approach to feature definition was applied to the entire site, many additional geophysical features could be defined. A more detailed descriptive and interpretive study of the entire Army City geophysical map is planned.

The resistivity maps of Army City are useful in several ways. In this project, the maps allowed Larson to position his test units and shovel tests where they could best recover information needed to assess the site's eligibility for the NRHP. Targeted on several feature complexes, the 1997 excavations demonstrated the presence of in-situ architectural remains in some areas and dense deposits of demolition rubble at other locations. The spatial patterning of the architectural remains as seen in the resistivity map and verified by excavation was found to correspond to the Army City complex's layout as shown in period maps and photographs. The 1997 excavations also documented a well-preserved artifact assemblage consistent with the site's known dates of occupation, functional charac-

ter, and mode of demolition. Larson and Penny (Chapter 5 of this report) found that the Army City site is eligible for nomination to the NRHP under Criteria A and D.

It is unlikely that so much information relevant to an NRHP assessment of the site would have resulted from such limited investigations had the resistivity map not been available to guide the excavations. While the unique character of Army City made it a very strong candidate for NRHP eligibility, one can easily imagine how a geophysical survey would also greatly expedite the NRHP assessment of other large, less unique historic site complexes.

The resistivity maps of Army City also represent a valuable management tool. The maps will allow the Fort Riley cultural resources managers to identify portions of the site characterized by important archaeological deposits. By avoiding these areas when plans are developed for future roads, buildings, or underground utility lines, it will be possible to minimize costs associated with cultural resource investigations.

Farmsteads

Geophysical surveys and ground-truthing excavations at the historic farmstead sites were productive but yielded results that were far less dramatic than the work at Army City. Each of the farmstead surveys identified a relatively small number of geophysical features. Unlike Army City, Somers numbered and interpreted essentially all of the geophysical features at the farmsteads that were believed to correspond to important archaeological deposits. Overall, the geophysical features defined at the farmsteads tend to be smaller and less internally complex than those at Army City. Nevertheless, thorough excavation of some of the individual geophysical features at the farmsteads would probably result in the definition of multiple archaeological features.

Somers defined 11 geophysical features at 14RY2118. Some of these features are noteworthy in that they are interpreted as natural phenomena or, in some cases, natural phenomena that may have been culturally modified. For example, Features A, AA, C, CC, D, and DD are interpreted by Somers as possible quarry faces, whereas Feature B is interpreted as a deposit of deep, moist soil.

Excavations at 14RY2118 focused on investigating features and artifact concentrations that were visible on the surface rather than on the geophysical features. Based on the site's relatively early occupation, the integrity of the deposits, the presence of architectural remains, and an artifact assemblage compatible with

the site's age and functional character, Larson and Penny found that this site is eligible for nomination to the NRHP (Larson and Penny, Chapter 5 of this report).

The geophysical surveys at 14RY152 identified 13 resistivity and 6 magnetic features. Following consultation with Somers, Larson selected Features A and F as the best locations for test units. Both of these features represented linear areas characterized by an abrupt transition between high and low resistivity. The excavations at 14RY152 produced little information about the origins of the anomalies. The site was found to be heavily eroded and disturbed by military training activities. As such, it was not viewed as eligible for nomination to the NRHP (Larson and Penny, Chapter 5 of this report).

Similar results characterized the excavations at 14RY2170. Based on results of the geophysical survey, Somers characterized the site as heavily disturbed, but did identify eight high-resistivity features. The two test units targeted on geophysical features interpreted as building rubble and/or the remains of floors (Features C and G) encountered no architectural remains, but did document evidence for vehicular compaction of the clayey soil. The rest of the resistivity features at that site were investigated using shovel tests. Several of the tests produced cultural material, but only one encountered evidence of architectural remains, a large piece of dressed limestone interpreted as a building footing or foundation element. On balance, site 14RY2170 was found to be heavily disturbed and not eligible for nomination to the NRHP (Larson and Penny, Chapter 5 of this report).

Somers identified 10 resistivity features at 14RY2171. Larson investigated the two most promising features (G and E) with test units. One of these units encountered a band of platy clay that could correspond to a drip line and could thus account for the resistivity feature. The other unit did not encounter the expected substantial architectural remains, but did document a modest concentration of window glass and some brick fragments. These materials were compatible with the expectation that Feature G represented a deposit of building debris. The other eight resistivity features were investigated using shovel tests, but only one of these produced cultural material. On balance, results of the ground-truthing excavations at 14RY2171 were mixed, with the materials encountered in the test units being less dramatic than was expected based on the resistivity maps. Larson and Penny (Chapter 5 of this report) recommended additional excavations at 14RY2171 before making a recommendation about NRHP eligibility.

Farmstead 14GE1108 served as an alternate site, to be investigated only if military training precluded excavations at one of the other sites. Somer's resistivity

survey of 14GE1108 identified nine anomalies, three of which were interpreted as possible architectural features. However, no archaeological excavations were conducted, and the site's NRHP eligibility status was not determined.

Methodological Issues

Site Formation Factors

The site assessment strategy based on geophysical survey and targeted ground truthing excavations worked much better at Army City than at the four historic farmsteads. One factor that contributed to this difference in success is the nature of the archaeological record. Army City includes some massive deposits of building debris. In terms of resistivity values, these massive archaeological deposits contrast sharply with the surrounding areas. The presence of such deposits is not, however, the only reason that the investigations at Army City were so successful. Somers notes that Army City also contains some very subtle, low-contrast features that are also likely to correspond to archaeological deposits of interest.

Site formation processes, particularly the manner in which the architecture at the sites was demolished and (in some cases) removed, are a second factor affecting project success. At Army City, a number of the buildings in the commercial district burned in 1920. Some of the debris may have been hauled away, but much of the remains of the Hippodrome complex were buried at their original location. Of the buildings that did not burn, some were disassembled and sold as scrap, whereas others were moved to nearby Ogden (Rion 1960). This careful removal resulted in the preservation of a geophysical "footprint" for some of the buildings. The footprint is the result of remaining architectural elements (footings, wall posts, builder's trenches, etc.), sharply demarcated traffic patterns, differences in compaction, displaced soil and gravel, and so forth. On balance, the demolition activities at Army City did not obscure geophysical evidence for building locations.

Perhaps the most important factor that contributed to the successful investigations at Army City is the limited extent of post-demolition disturbance. The construction of the earthen levee on the western edge of the site, and of the E Street Extension on the east, did impact the site margins. Most of the site, including the commercial district, has not only escaped impacts from new construction, but has also escaped the effects of modern agriculture. Excavations conducted thusfar provide no indication of a post-1920 plow zone. More importantly, most of the site has not been used for military training that involved extensive heavy vehicle

traffic (the northeastern portion of the site is reported to have been used in training truck drivers during the early 1980's) (Kreisa and Walz 1997:89).

In a recent NRHP eligibility assessment of eight historic farmsteads at Fort Riley, Halpin (1997) reports information from a long-term resident concerning the treatment of buildings that were purchased by the government in the mid-1960's. Landowners were given a choice of selling all of their buildings to the government or removing some or all of them to other locations. Buildings that were not removed were, with some exceptions, eventually demolished or burned by the Army Corps of Engineers. Standard practice was to use bulldozers to bury the remaining debris (Halpin 1997:146). This action would have created large and presumably high contrast geophysical features. No such features were identified at the farmsteads investigated in 1997 by Somers and Larson. In situations where buildings were removed, one assumes that no large debris concentrations were created. In the absence of a cellar or concrete foundation, the only evidence that a structure had once been present might be some isolated foundation elements such as stone footings. Sites 14RY152 and 14RY2170 are located within the 1965 purchase area, and the buildings were probably removed from these sites. This removal probably accounts for the presence of an open cellar at 14RY152, and the scarcity of building debris at both sites.

14RY152 and 14RY2170 have both been heavily disturbed by military training. Impacts include heavy vehicular traffic, the excavation of fighting positions, and erosion. These impacts may have obscured some of the lower contrast geophysical features. It may also be, however, that some of the high-resistivity features (such as Features C and G at 14RY2170) mark the past locations of structures. Removal of the structure from these locations left only traces of such building materials as flat glass, small pieces of brick and concrete, etc. This scenario accounts for the presence of a geophysical anomaly suggestive of a structure, as well as the recovery of very sparse amounts of building debris.

Mapping

The results of geophysical surveys are interpreted visually (by looking at maps) rather than by means of a numeric analysis. The quality of data imaging thus plays a central role in the success of a project.

Somers found that the Army City resistivity survey presented some challenges in data imaging. The main problem was the data set's large dynamic range. Cultural features with resistivity values less than 0.1 Ohm are present throughout the Army City map. Also present are high-resistivity features such as the dense concentrations of building debris associated with the Hippodrome complex.

These high-resistivity features have values that exceed 20 Ohms. In this situation, the highpass filter process that is typically used to remove the effects of variation in background resistivity creates a halo effect around the large high-contrast features. This halo masks the small, low-contrast features that may be of great interest to the archaeologist. Somers resolved this dilemma by producing the Army City maps using a batch processed nonlinear highpass filter in combination with a hybrid gray-scale contour map format. This process achieved the desired results, but involved a great deal of additional labor. Thus, Somers identified the development of software that could deal with this problem as an area of research that could significantly improve the cost effectiveness of geophysical investigations.

To present the Army City data in a manner useful to archaeologists, Somers found it necessary to produce both large-format/small-scale maps and small-format/large-scale maps. Large-format (ca. 4x4 ft) maps at scales of 1:500 and 1:600 showing the entire site are useful in managing the site. These maps will allow the Fort Riley CRM to identify locations for new buildings, roads, or pipelines so that impacts to the site and costs associated with future cultural resources work there will be minimized. Smaller format, larger scale maps (e.g., 1:200) are also useful, particularly when a 1-m grid is superimposed over the geophysical data. Such maps allow excavation units to be placed very accurately relative geophysical anomalies.

Integration of Geophysics and Archaeology

At Fort Riley, the project geophysicist (Somers) and archaeologist (Larson) worked well together. The two had worked together previously, Somers had extensive familiarity with archaeological issues, and Larson had training and practical experience in geophysical survey. Larson consulted with Somers on a number of occasions while the archaeological investigations at Fort Riley were underway. These communications occurred via telephone and fax, although in-person consultation in the field would have been preferable.

Achieving adequate interaction between a project geophysicist and archaeologist can be difficult when the two represent separate firms, have not worked together before, have little understanding of the other's discipline, and/or a significant time passes between the geophysical and archaeological fieldwork. Even where there is close interaction, the geophysicist and archaeologist may have very different expectations about the potential specificity of geophysical interpretations and recommendations. A geophysicist may interpret an anomaly as being associated with a concentration of building debris, yet not be able to predict the density of such material within some unit volume of soil. Upon excavation, an ar-

chaeologist expecting to encounter a building foundation may instead recover relatively few small pieces of building debris. If the archaeologist can undertake extensive excavations at a particular site, he/she may learn how to better interpret the geophysical map and the geophysicist's recommendations. But if geophysics is to be integrated into a site assessment strategy without a significant increase in cost per site, the amount of excavation typically conducted must be decreased, not increased.

In a site assessment, one of the geophysicist's primary contributions is to help the archaeologist position excavation units where they will produce the information essential to an assessment of NRHP eligibility. While a number of issues must be considered in a site assessment, fieldwork typically focuses on an effort to identify and characterize intact cultural deposits, particularly discrete deposits such as pits, hearths, and architectural remains. The archaeologist must provide the geophysicist with expectations about the nature, dimensions, and possible depth of archaeological features that could be present. Geophysical manifestations of archaeological features are highly variable, depending upon site-specific variables such as soil chemistry, moisture, the extent of surficial disturbances, etc. The geophysicist must use his/her understanding of these factors to design a survey that can detect cultural deposits in a cost-effective manner. There is no substitute for close interaction between highly experienced geophysicists and archaeologists.

Prioritizing Anomalies for Ground Truthing

At many sites, geophysical surveys will identify few or no anomalies suggestive of the presence of cultural deposits. In some cases, however, a survey may identify a very large number of anomalies. The four farmsteads investigated at Fort Riley in 1997 exemplify the first situation, whereas Army City provides an example of the alternative possibility. At Army City, there were so many interesting and potentially significant anomalies that selecting the locations for a few ground-truthing units was not too difficult. In general, geophysical maps of historic sites are more readily interpretable than are maps of prehistoric sites because the architectural remains present at many historic sites often have clearly discernable and highly interpretable geophysical expressions. In contrast, prehistoric sites may consist of a seemingly random scatter of pits that are similar in size and appearance to natural phenomena such as tree roots. In most site assessments, the budget will allow ground truthing excavations of, at most, 5 or 10 anomalies. Typically, only a few of these can be investigated using formal test units. At this point the geophysicist and archaeologist must work together to prioritize the anomalies so that those most likely to represent intact cultural

deposits can be examined first. If these prove to be noncultural, one can reasonably assume that the others can be dismissed.

Although selecting anomalies for ground truthing was not too troublesome in the 1997 work at Fort Riley, it is likely to emerge as a problem as additional sites are investigated. It may be useful to briefly discuss a five-stage strategy for prioritizing anomalies that was recently used with good results at Fort Leonard Wood, MO (Ahler et al. 1999; Hargrave et al. 1999). Resistivity and gradiometer surveys at the Crying Hawk site (23PU556) identified approximately 140 anomalies. Following the completion of the survey, the geophysicist identified the most promising anomalies based on their contrast with surrounding areas, their spatial distribution, and their size and shape relative to those of cultural features. Upon inspecting the site at a time when surface visibility was excellent, the archaeologist found that a number of the high priority anomalies appeared to correspond to tire tracks and other recent military disturbances. Following consultation with the geophysicist, the archaeologist conducted a five-stage screening strategy to identify the most promising anomalies. The five stages were as follow:

1. A systematic visual inspection was conducted to correlate anomalies with evidence (often subtle) for recent disturbances.

2. A metal detector was used to search for recent metallic debris at the location of the magnetic anomalies (this eliminated most of the magnetic anomalies).

3. Oakfield cores were used to identify eroded or otherwise disturbed soil profiles. Cores were distributed in transects to allow a comparison of each anomaly with the surrounding area.

4. Paired shovel tests (one located within and one just outside of an anomaly) were excavated to further ascertain the presence of disturbed soil profiles, and to assess artifact density.

5. Test units were excavated to investigate the most promising anomalies.

Using this strategy, eight anomalies were eventually investigated using paired shovel tests, and four of these were investigated by test units. Three of the units encountered large and/or abundant root disturbances but no discernable cultural features. One unit identified a diffuse area of compacted, slightly mottled sediments that was interpreted in the field as a possible disturbed hearth or living surface. Soil chemistry analyses later determined that this deposit was characterized by concentrations of calcium, magnesium, potassium, and phosphorous

that were 1.5 to 3.0 times greater than those of the surrounding soils. These findings supported the interpretation that the high-resistivity anomaly investigated represented the disturbed remains of a hearth or other living surface (Ahler et al. 1999:105).

On balance, the use of geophysics at the Crying Hawk site was considered to have been quite successful. Most of the anomalies identified at the Crying Hawk site did not represent cultural features, but the use of a systematic screening strategy did allow a cultural feature to be identified. Identification of a single feature would not be a noteworthy event in some regions. At Fort Leonard Wood, previous excavations at a number of open habitation sites had very rarely identified discrete cultural features such as pits or hearths.

Ground-Truthing Excavation

Strategies for ground-truthing geophysical anomalies need to be adapted to local conditions. For example, Larson and Penny found that use of shovel tests was not the optimal approach to ground truthing at Army City. Artifacts and building debris were so ubiquitous that the results of ground truthing did not allow one to differentiate features (including architectural remains) from nonfeature locations. Larson and Penny suggested that, at Army City, units exposing at least 2 m^2 should be used to investigate individual resistivity features. In several cases, Larson and Penny found it useful to excavate relatively long, narrow trenches rather than square units. Trenches provide longer profiles, increasing the chances of intersecting linear features such as walls, and increasing the opportunities to view contrasts between feature and nonfeature deposits.

At Army City, Larson and Penny found that strongly linear anomalies (i.e., characterized by straight lines and right angles) tended to correspond to architectural remains that were consistent with period maps and photographs. In other words, anomalies that resembled well-preserved architectural remains proved to be just that. In contrast, resistivity anomalies with oval or rounded plans corresponded to deposits of building debris rather than well-preserved architectural components. Larson and Penny also found that resistivity anomalies with linear but broken (i.e., discontinuous) outlines corresponded to partial foundations or rows of discrete foundation elements (footings) (Larson and Penny, Chapter 5 of this report). These findings appear to make good sense, and suggest the potential for spatially extensive and reasonably detailed inferences about the nature and integrity of archaeological deposits at the site. Given the very modest amount of excavation done, however, many anomalies at the site remain difficult to interpret. Future excavations at Army City, perhaps conducted in the context

of an archaeological field school, could produce valuable information about the relationships between archaeological deposits and their geophysical expressions.

As noted previously, ground-truthing excavations had mixed results at the farmsteads. This is attributed to differences in site formation processes and the nature and extent of post-depositional disturbances. A number of the resistivity anomalies identified at the farmsteads proved to be "false positives." In other words, these anomalies appeared to represent possible cultural features, but ground-truthing excavations revealed little or no evidence for the presence of such deposits. Although the occurrence of "false positive" anomalies is not desirable, their presence in modest frequencies does not represent a reason to exclude geophysical survey from site assessment. The reliability of negative evidence (the absence of cultural features in areas where there are no geophysical indications of such deposits) is a more critical issue. The present study was not, however, designed to test the reliability of negative evidence.

Recommendations for Future Work

This project had two primary objectives: (1) to evaluate the NRHP eligibility of five historic period archaeological sites, and (2) to assess the role of geophysical survey techniques in archaeological site assessment. Based on his program of archaeological and archival investigations, Larson found that the Army City site (14RY3193) and farmstead site 14RY2118 are eligible for the NRHP, whereas farmsteads 14RY152 and 14RY2170 are heavily disturbed and are not eligible. At farmstead 14RY2171, test excavations focused on the southern part of the site. In that area, cultural deposits are shallow and heavily disturbed. Larson recommended additional investigations before the NRHP eligibility of 14RY2171 be assessed. Future excavations should focus on the portion of the site north of the TCA in order to determine the chronology, functional character, and integrity of deposits in that area.

The geophysical (resistivity) survey of the Army City complex was highly successful. The resistivity map shows a distribution of buildings, roads, and other features that corresponds closely to period maps and photographs. The limited ground-truthing excavations indicate that the resistivity map provides a substantial amount of information about the nature and integrity of the archaeological remains of this historically important site. Most importantly, the Army City resistivity map can be used by the Fort Riley CRM Administrator to help avoid significant archaeological deposits (and expenses associated with cultural resource investigations) when plans are made for future infrastructure development.

Results of the geophysical surveys at the farmstead sites were mixed. Extensive disturbance resulting from heavy vehicle traffic lessens the potential for identifying subtle (low-contrast) features. Some of the geophysical anomalies identified as possible cultural features were found to be "false positives." In other words, ground-truthing excavations yielded little or no evidence for cultural deposits at those locations.

Given these findings, the following recommendations for future geophysical investigations at Fort Riley are offered:

1. Continue to use resistivity to investigate historic sites, including many (but not all) of the farmsteads. Resistivity will be most useful at sites characterized by modest vehicular disturbance, and where architectural remains are likely to be present but are not clearly discernable on the surface. To the extent that early historic sites may tend to occur in alluvial settings, geophysics should be particularly useful in locating architectural remains and other features (pits, privies, graves).

2. Identify situations where the validity of negative evidence can be assessed. The ideal situation would be to conduct geophysical surveys at archaeological sites where subsequent infrastructure development will allow mechanized removal of the topsoil in order to document the presence/absence of cultural features. Admittedly, such situations tend to occur very rarely. A more practical alternative approach would be to conduct geophysical surveys at sites where historic buildings, roads, or other features are known to have been present (based on historic maps and/or photographs). Failure to identify geophysical evidence for the archaeological remains of such features would indicate that negative geophysical evidence was not reliable.

3. Use geophysics to minimize or avoid costs of cultural resource investigations associated with future infrastructure development. As recommended above, the Fort Riley Cultural Resources staff should systematically conduct resistivity surveys in areas where historic buildings or features were once present. The resultant maps can be used by planners to minimize the impacts (and associated costs) of future developments on cultural resources.

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Figures

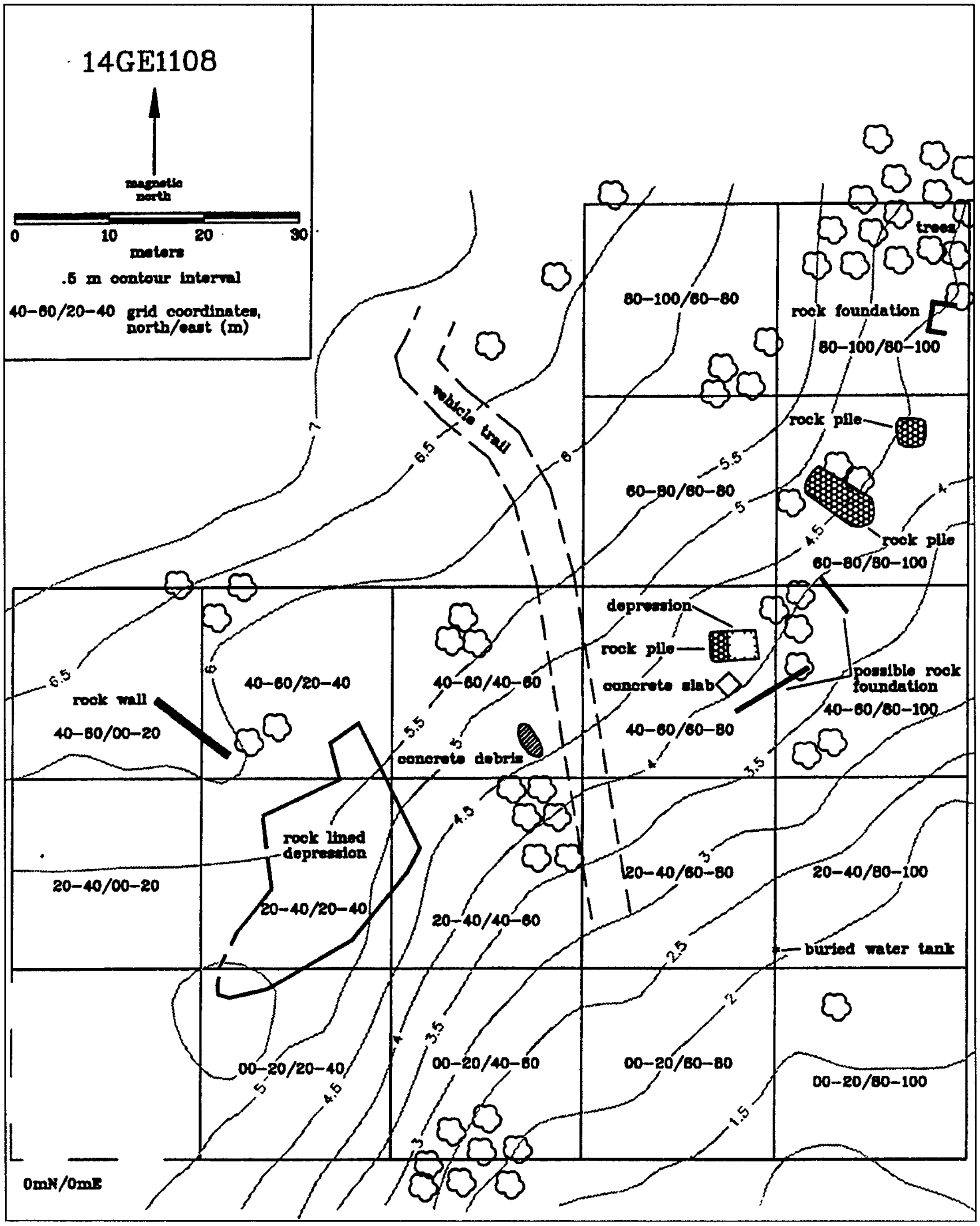

Figure 1. Surface feature map of Farmstead 14GE1108 (Larson and Penny 1998).

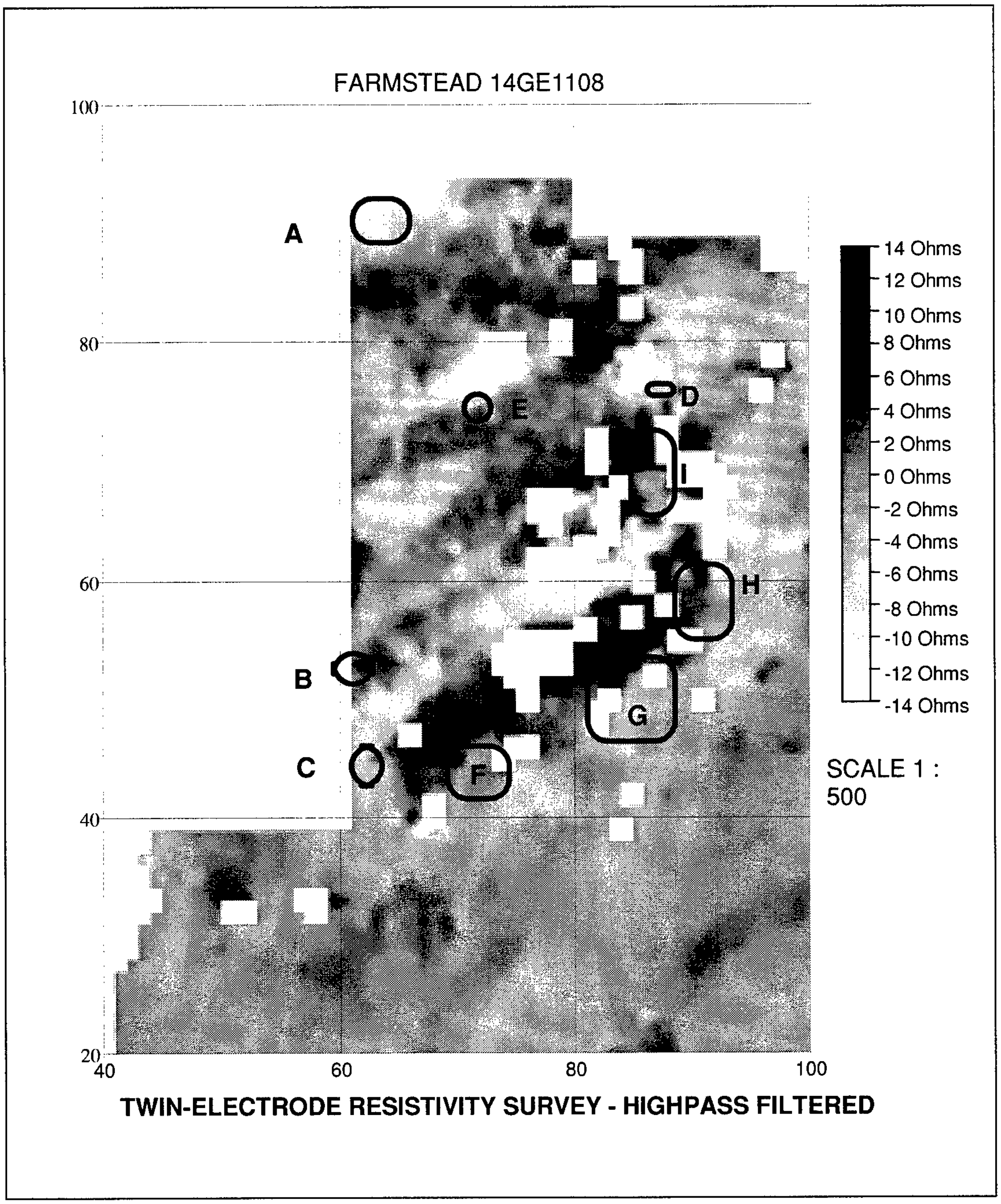

Figure 2. Resistivity map of Farmstead Site 14GE1108 (Somers 1998).

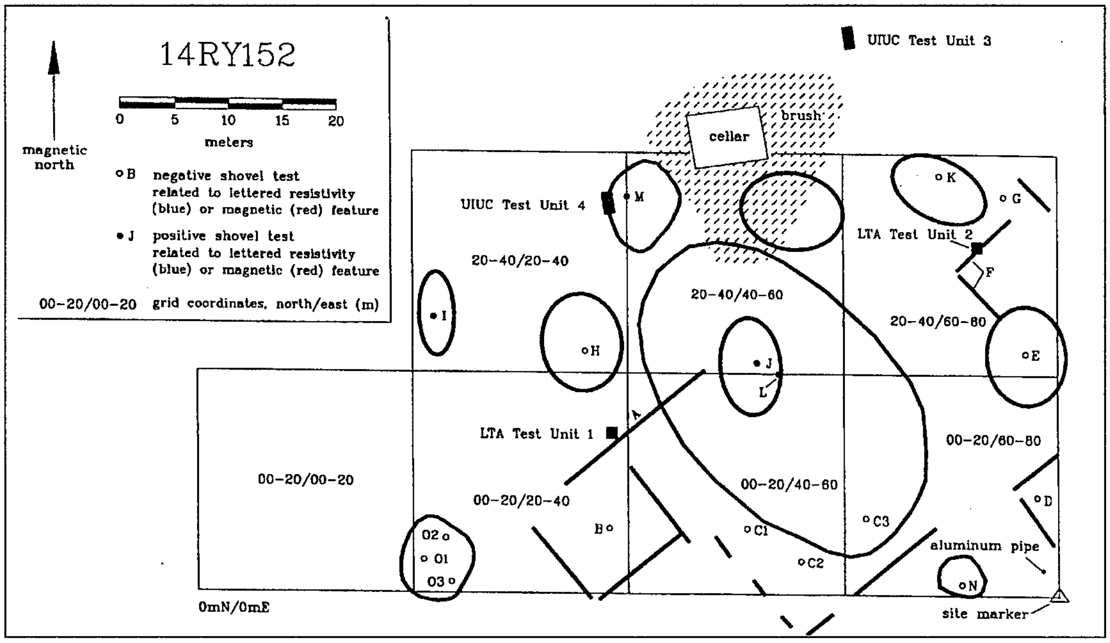

Figure 3. Surface feature map of Farmstead 14RY152 (Larson and Penny 1998).

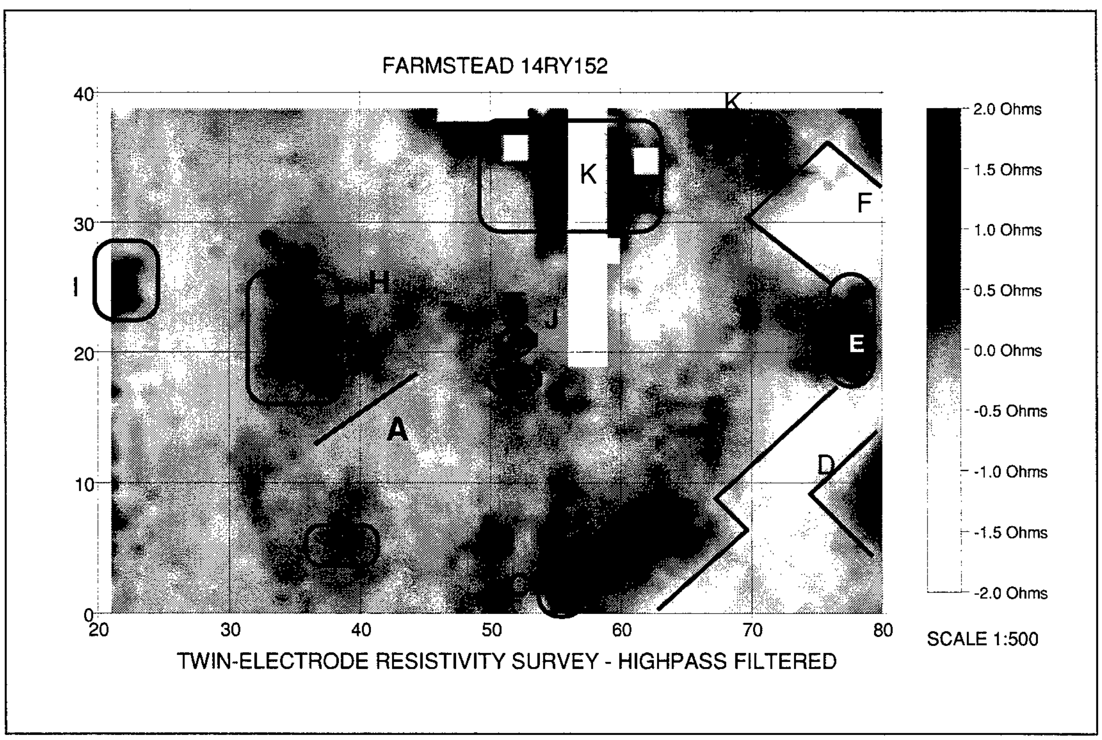

Figure 4. Resistivity map of Farmstead 14RY152 (Somers 1998).

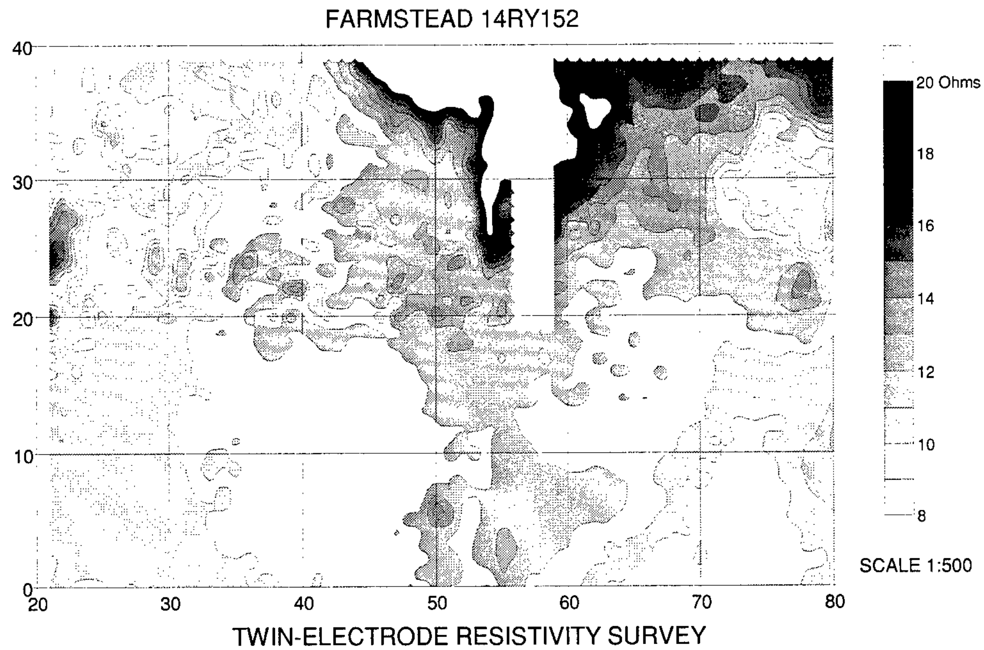

Figure 5. Resistivity contour map of Farmstead 14RY152 (Somers 1998).

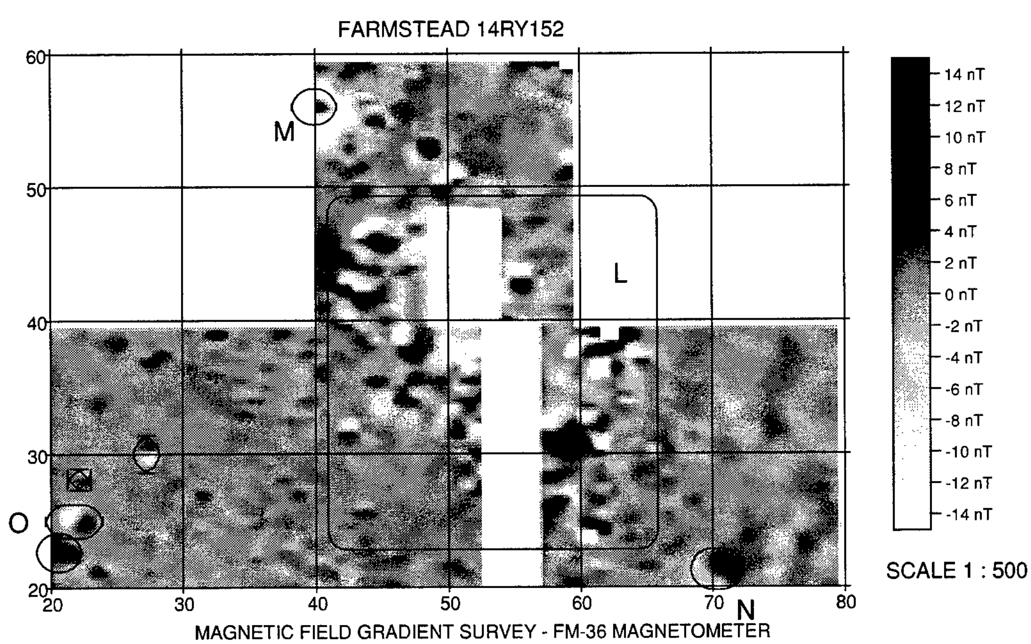

Figure 6. Magnetic map of Farmstead 14RY152 (Somers 1998).

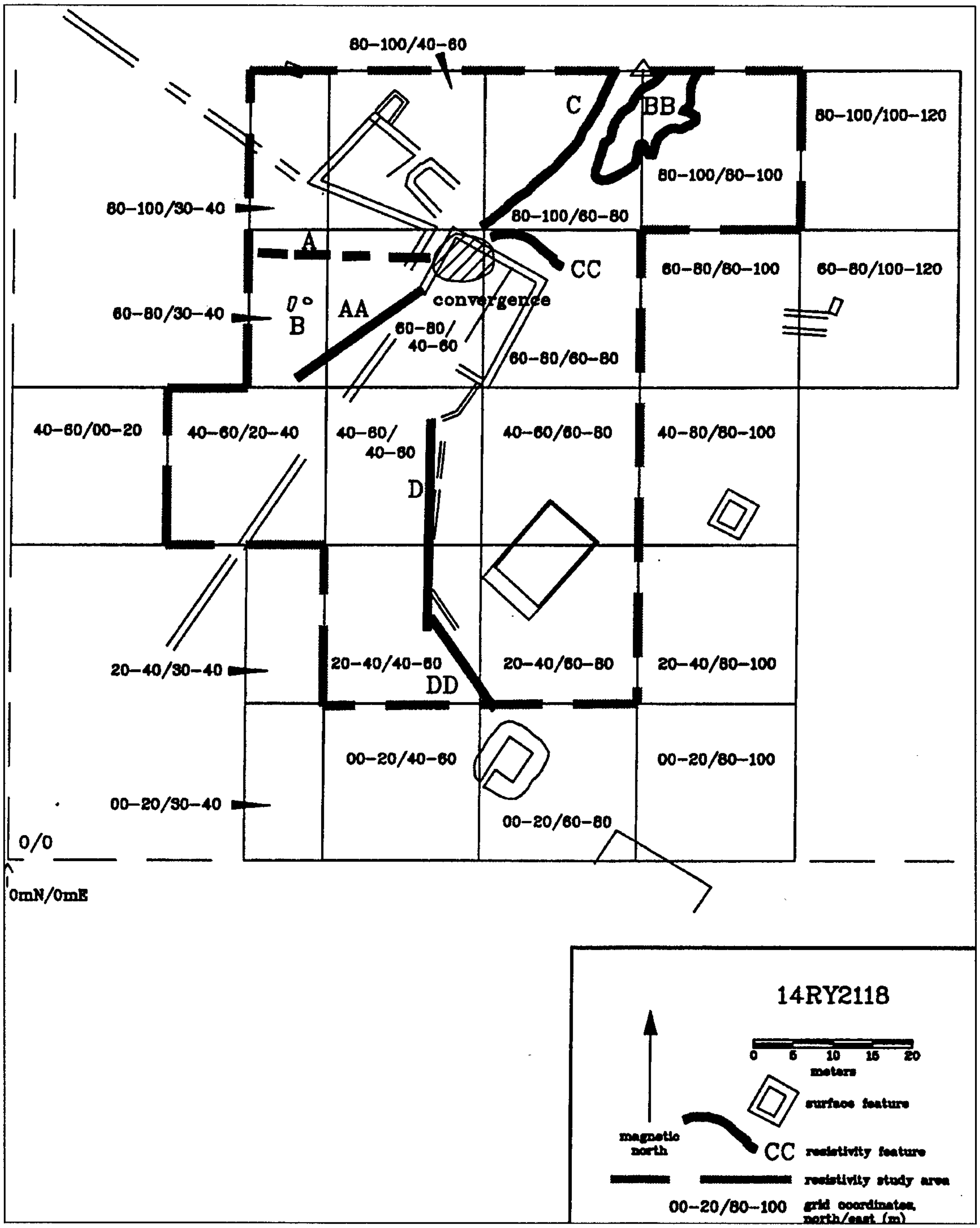

Figure 7. Surface feature map of Farmstead 14RY2118 (Larson and Penny 1998).

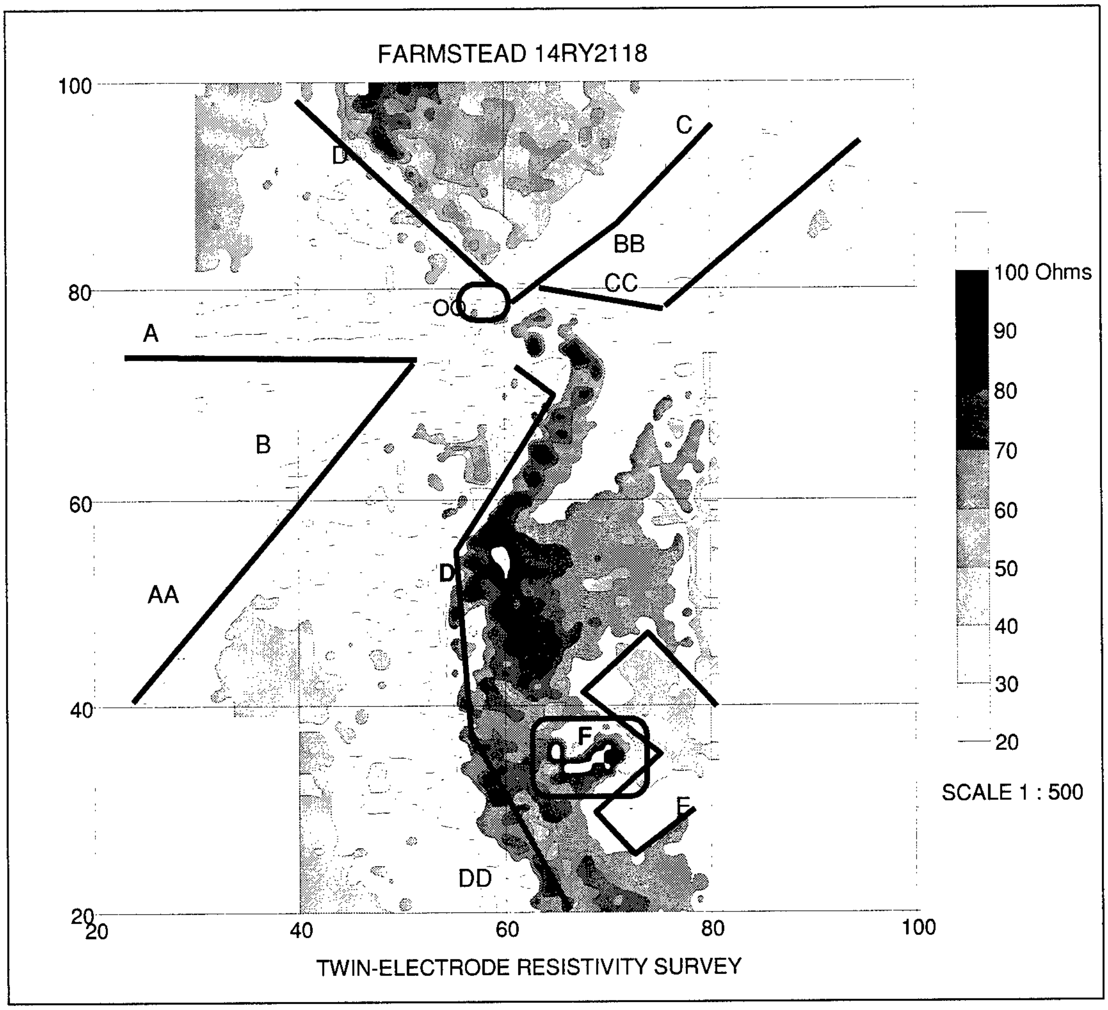

Figure 8. Resistivity contour map of Farmstead 14RY2118 (Somers 1998).

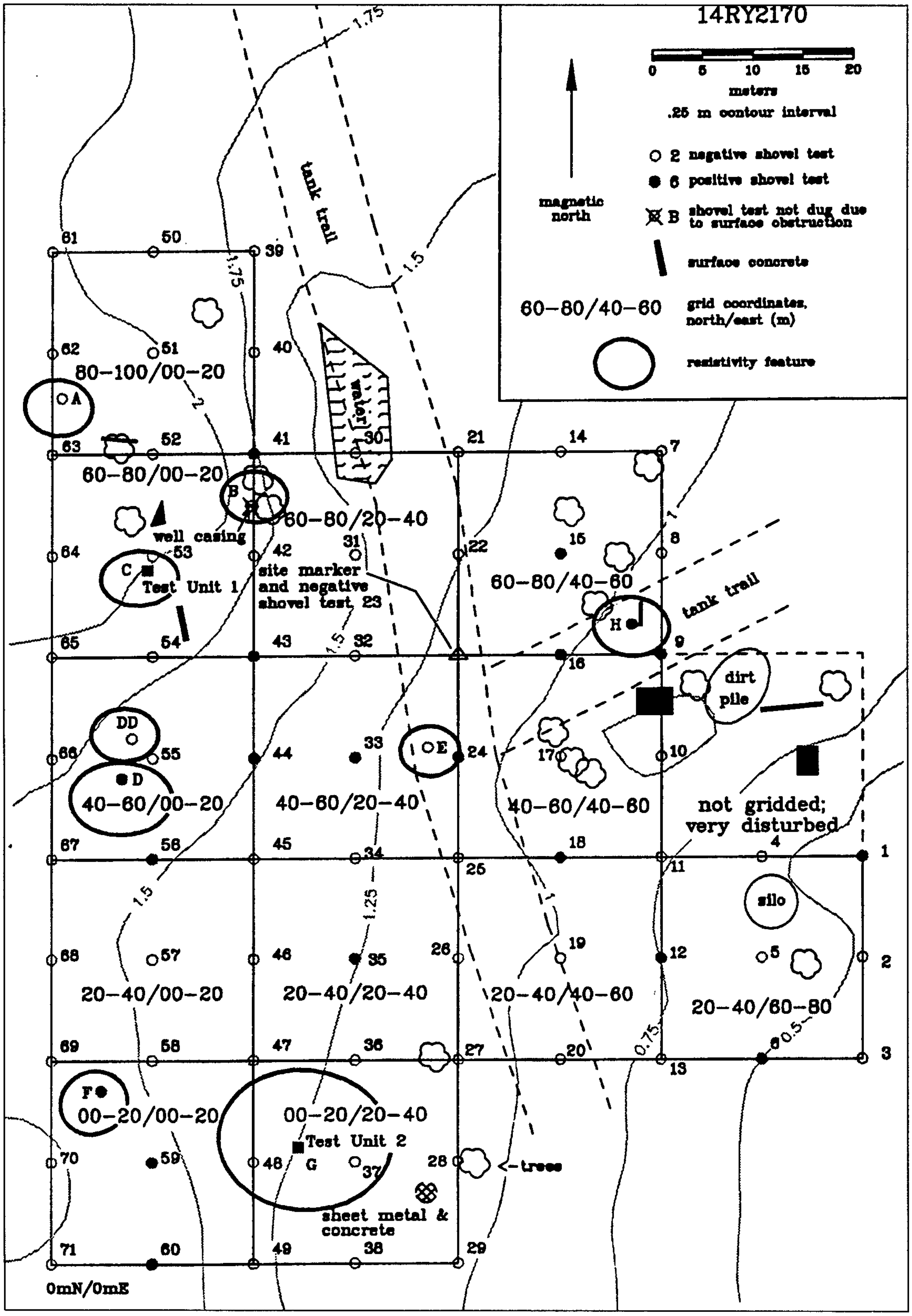

Figure 9. Surface feature map of Farmstead 14RY2170 (Larson and Penny 1998).

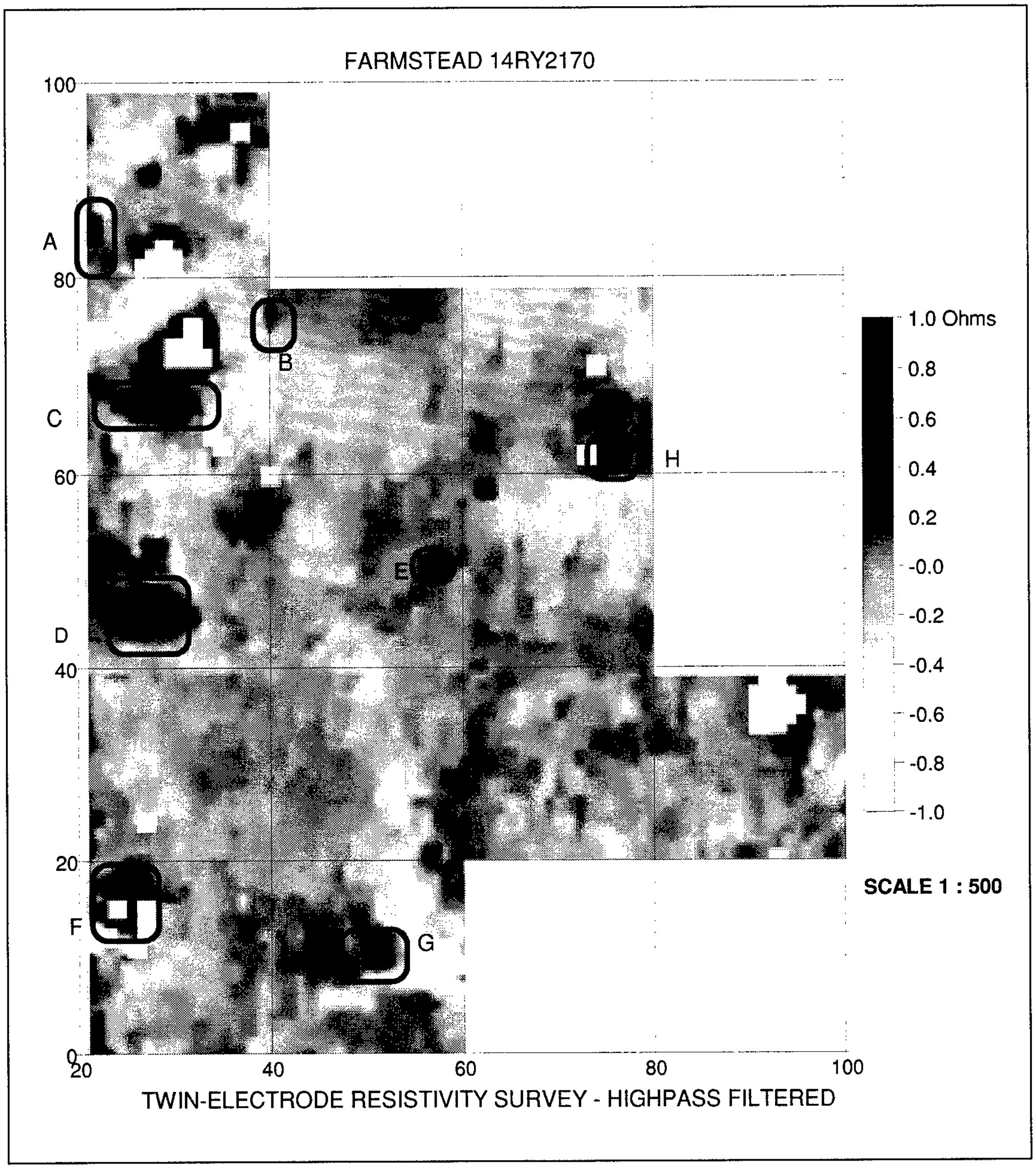

Figure 10. Resistivity map of Farmstead 14RY2170 (Somers 1998).

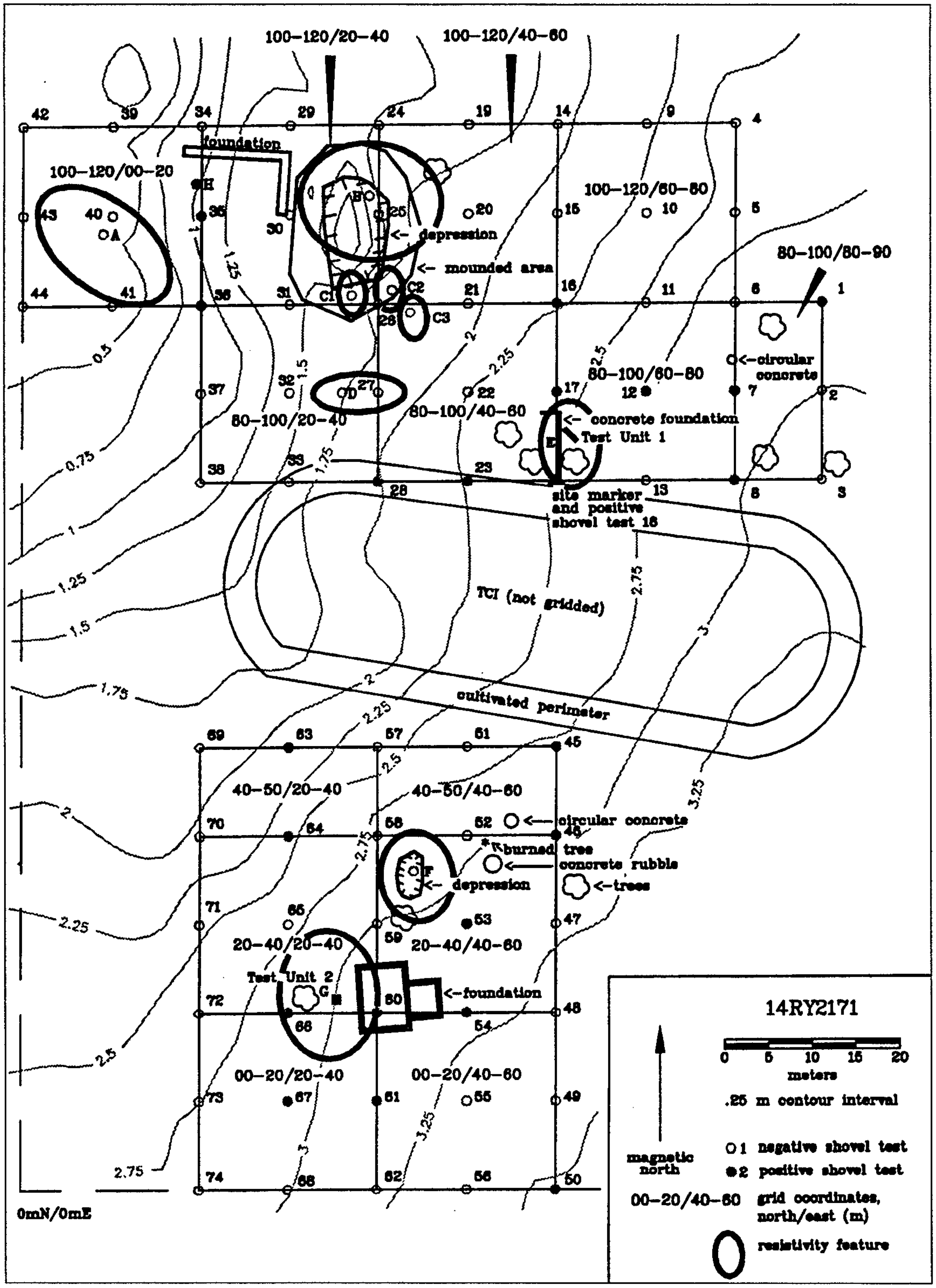

Figure 11. Surface feature map of Farmstead 14RY2170 (Larson and Penny 1998).

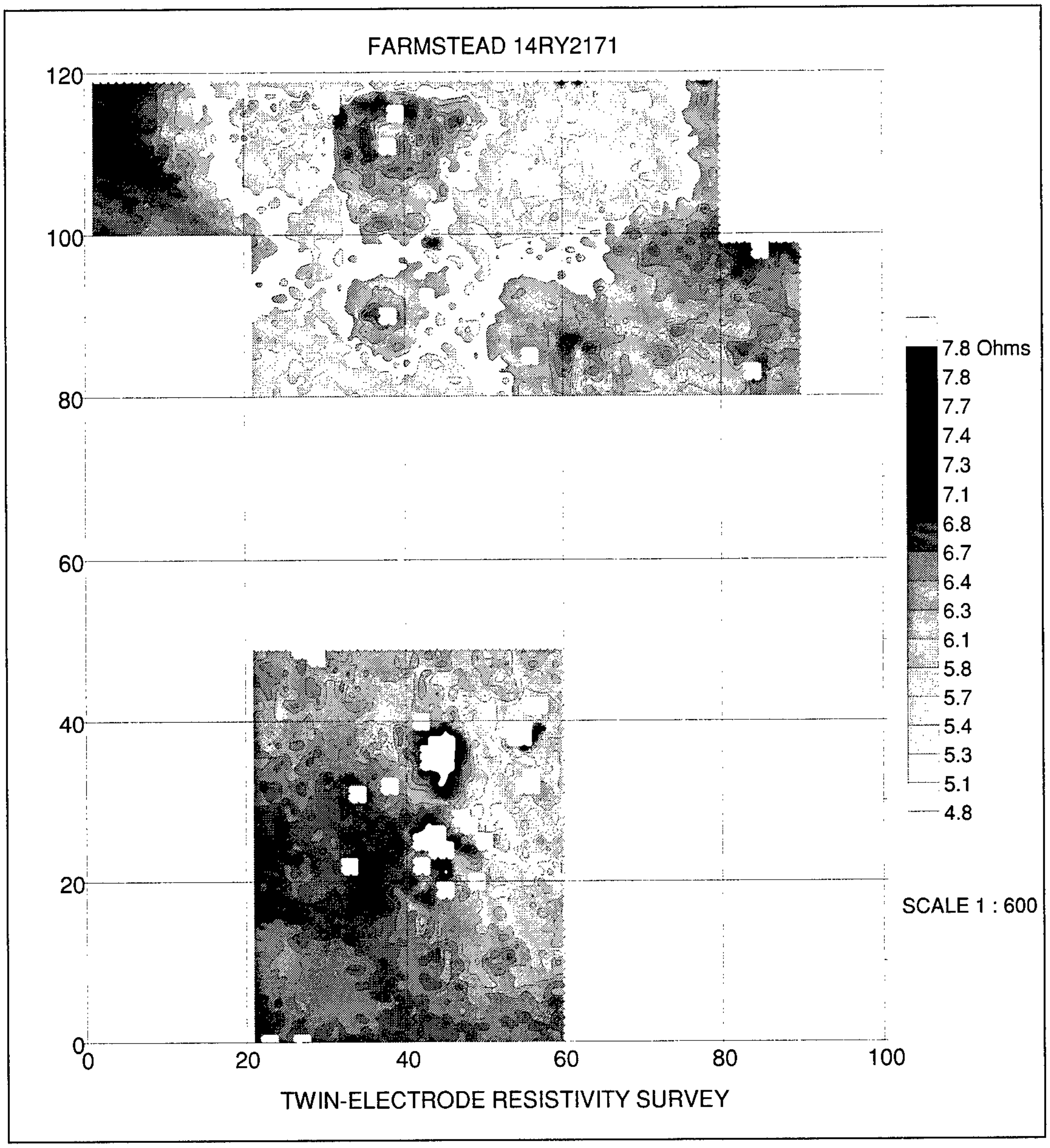

Figure 12. Resistivity contour map of Farmstead 14RY2171 (Somers 1998).

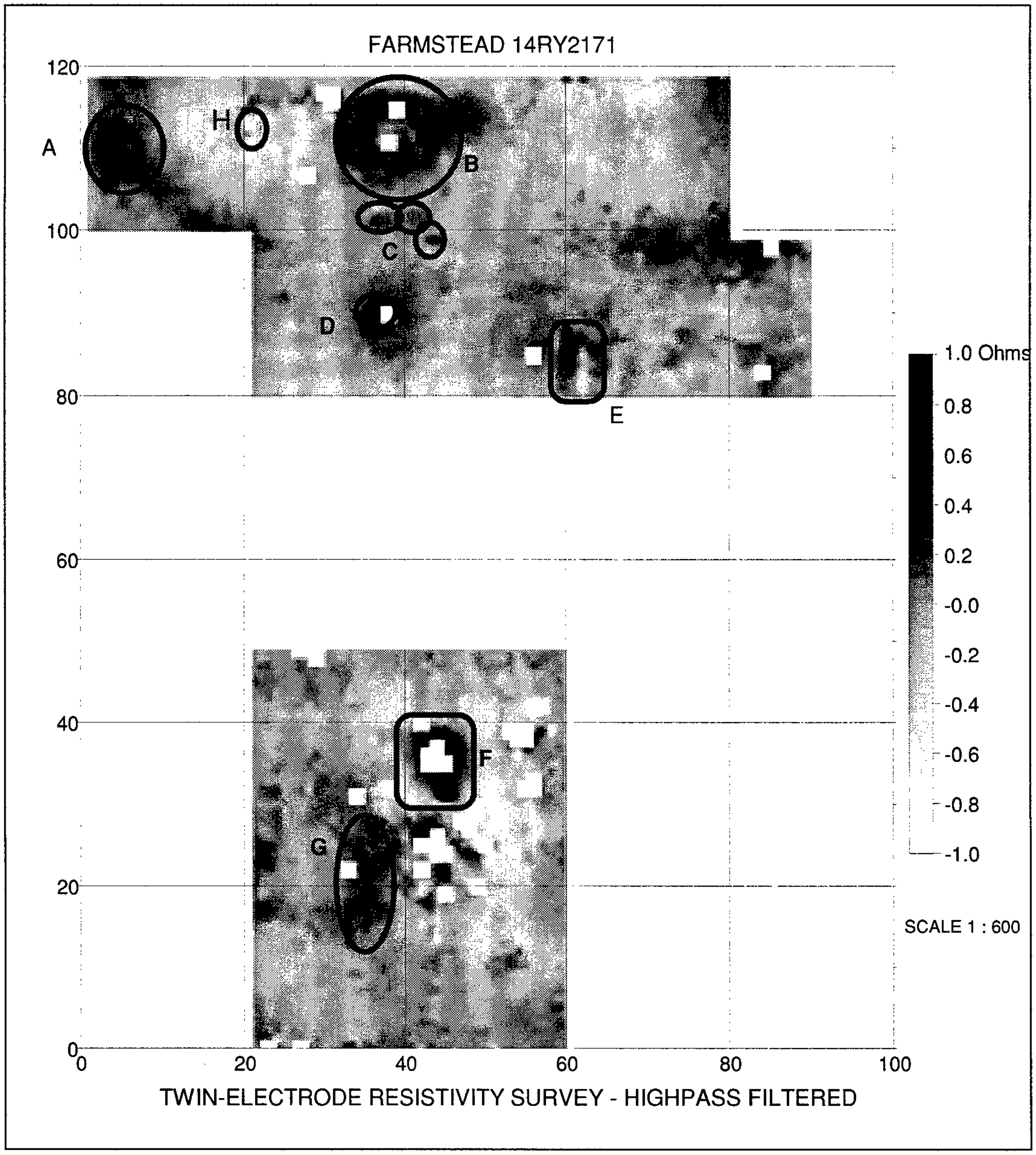

Figure 13. Resistivity map of Farmstead 14RY2171 (Somers 1998).

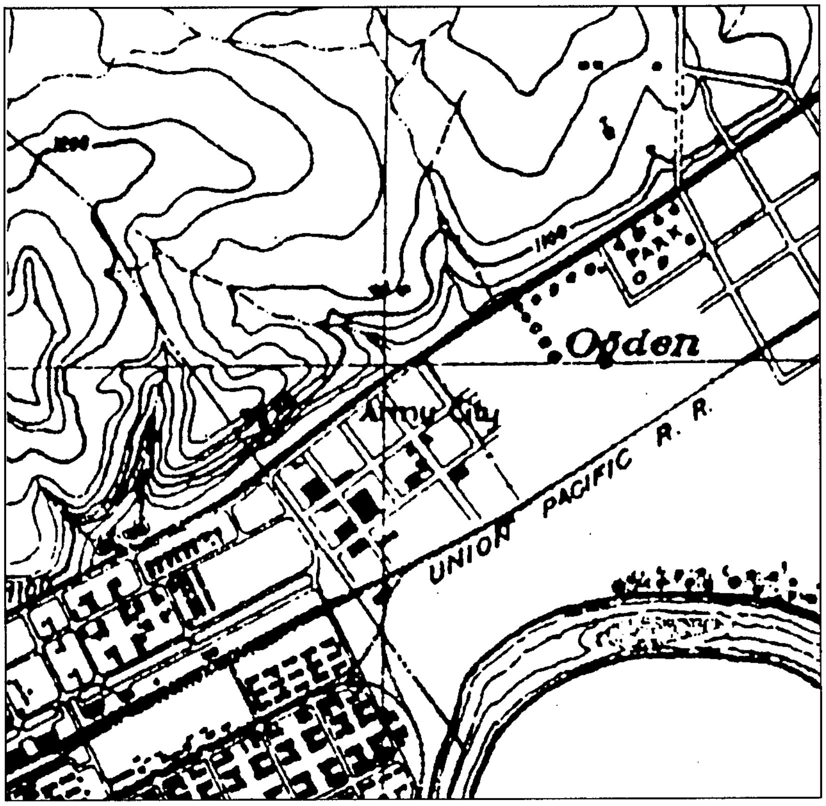

Figure 14. Plan map of Army City, 14RY3193 (from a 1917 map of Fort Riley).

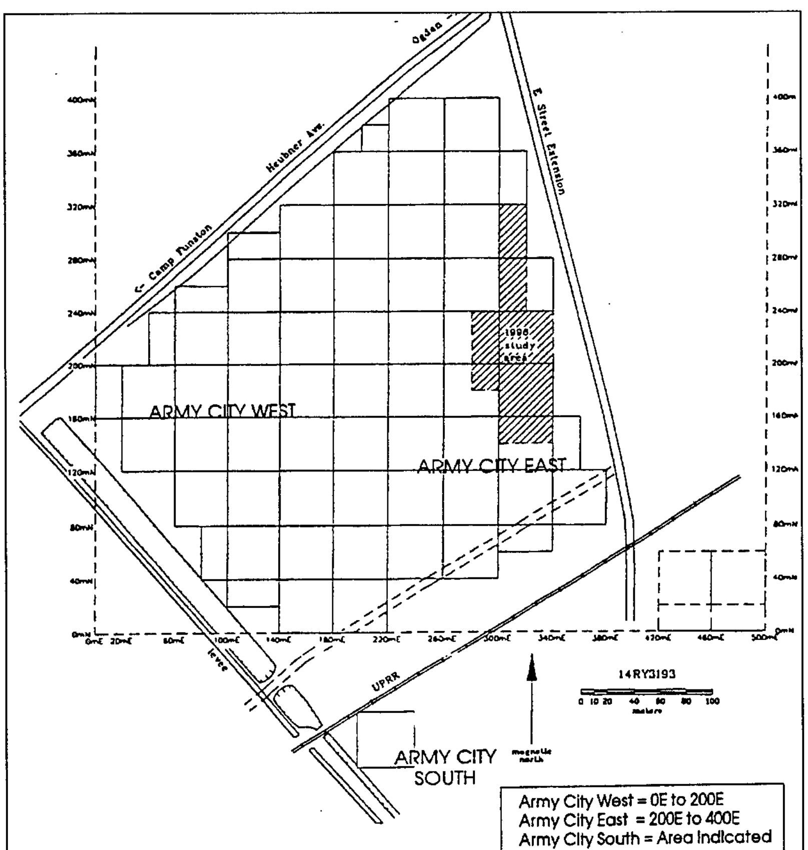

Figure 15. Plan of Army City showing east, west, and south survey areas (Larson and Penny 1998)

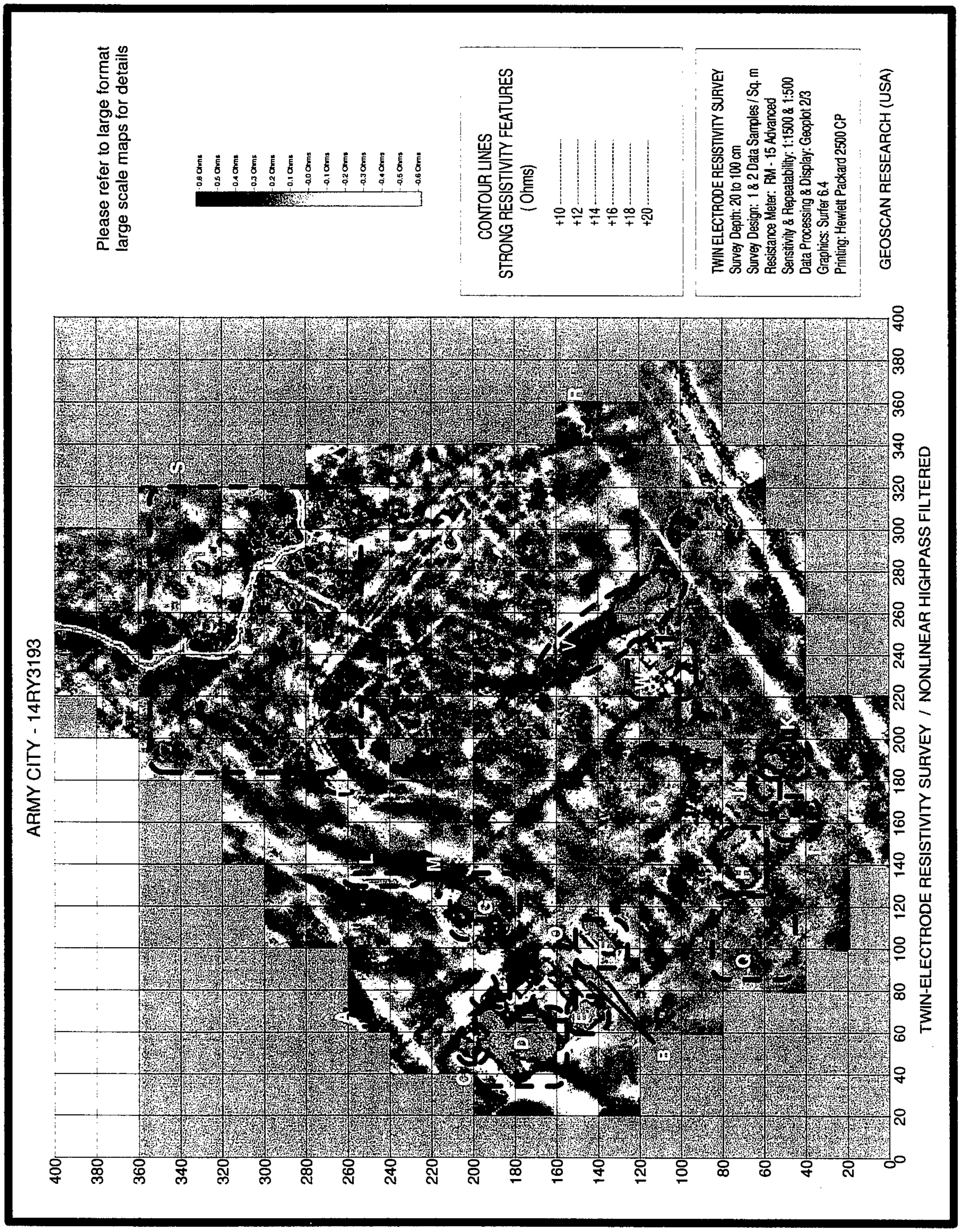

Figure 16. Resistivity map of Army City Site 14RY3193 (Somers 1998).

Figure 17. Resistivity map with 1-m grid of Hippodrome area, Army City Site 14RY3193 (Somers 1998).

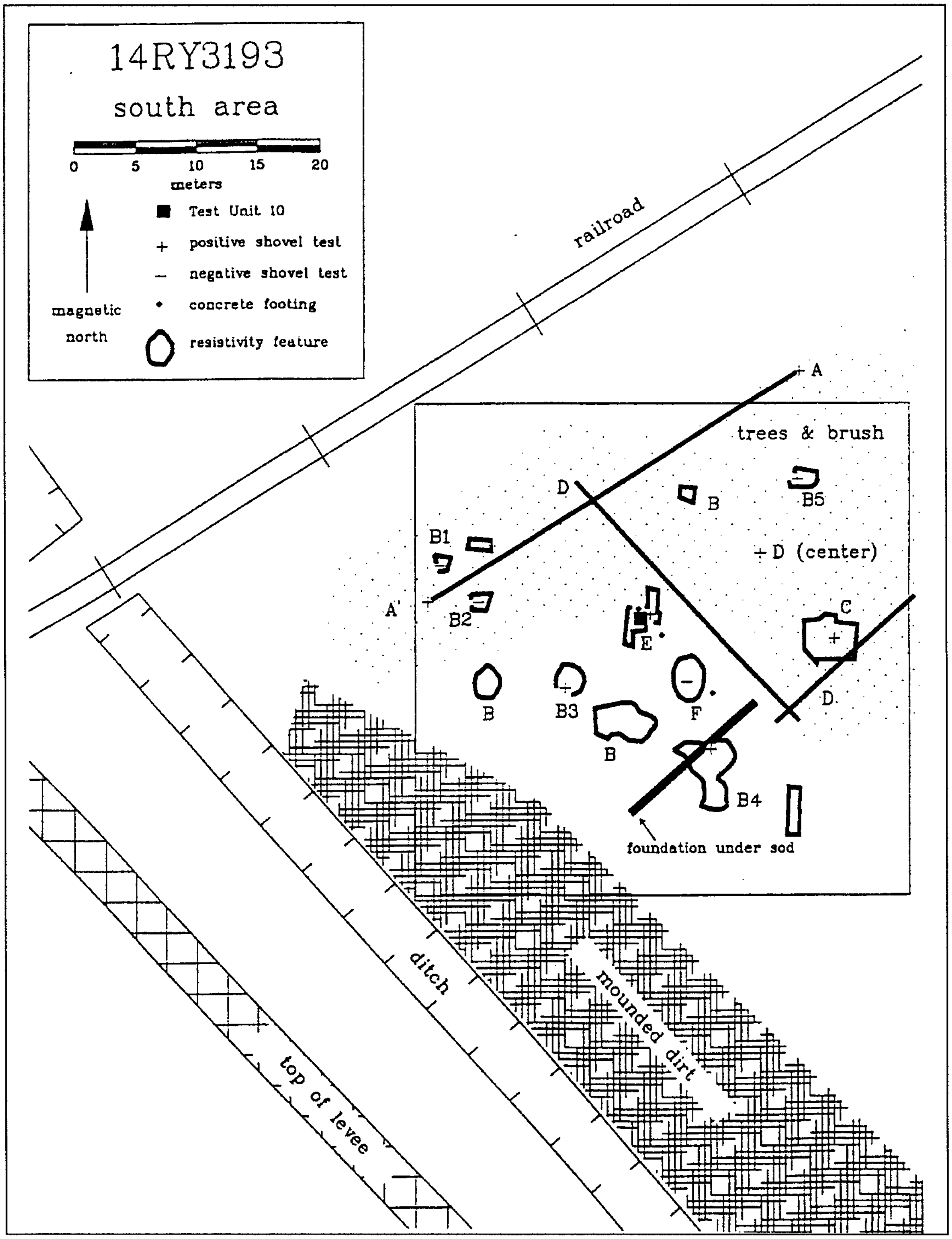

Figure 18. Surface feature map of south area, Army City Site 14RY3193 (Larson and Penny 1998).

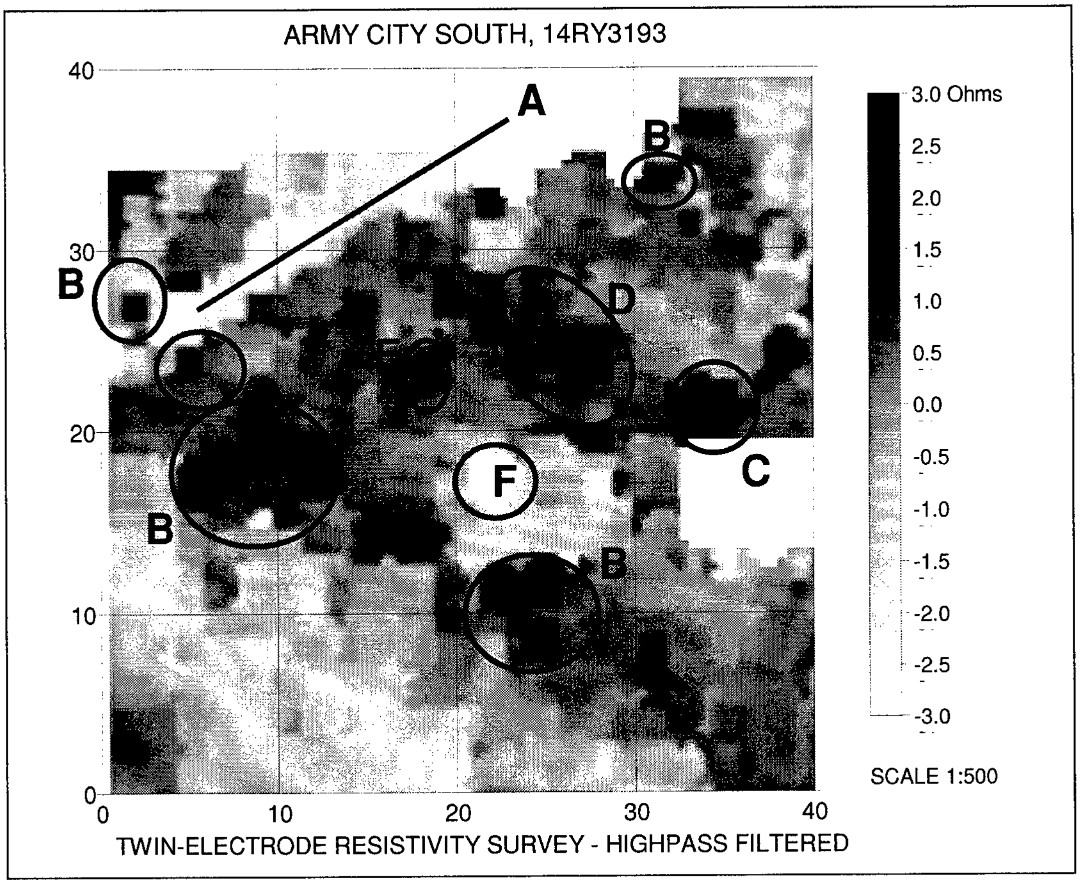

Figure 19. Resistivity map of Army City South, 14RY3193 (Somers 1998).

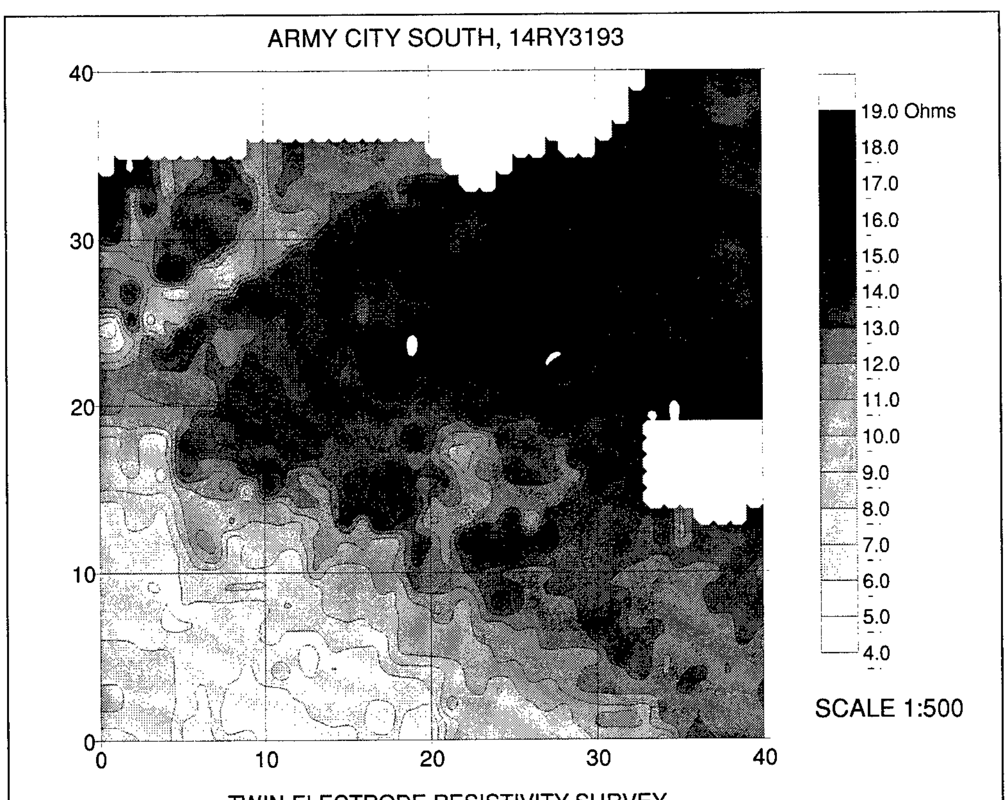

Figure 20. Resistivity contour map of Army City South, 14RY3193 (Somers 1998).

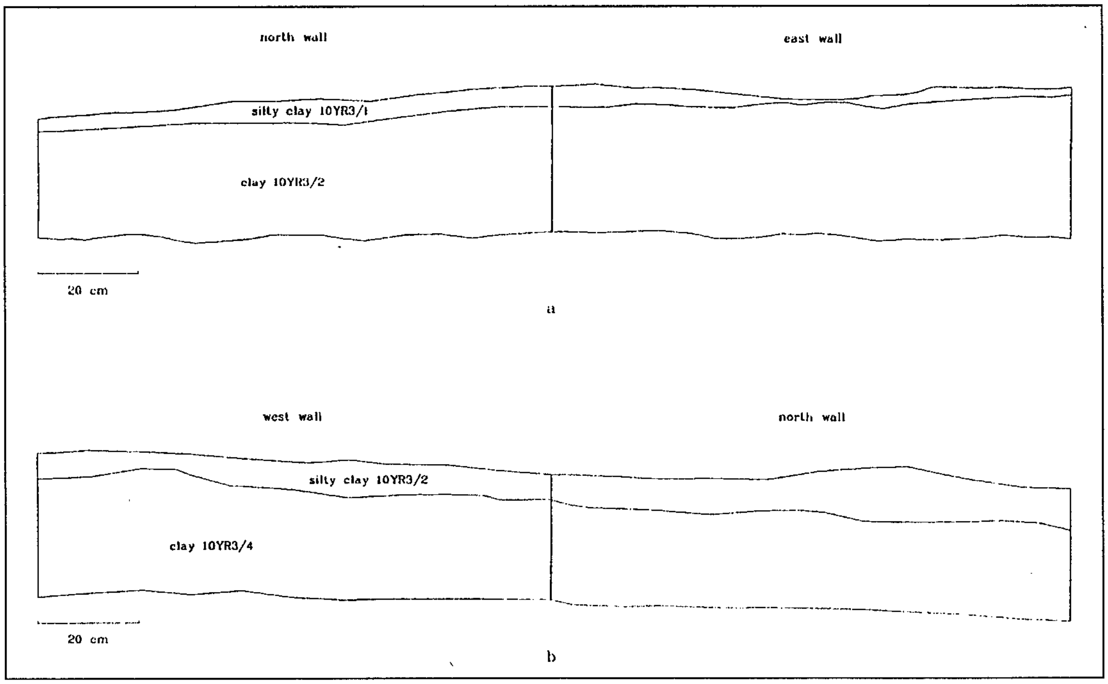

Figure 21. Profiles of Test Unit 1 (a) and Test Unit 2 (b), 14RY152 (Larson and Penny 1998).

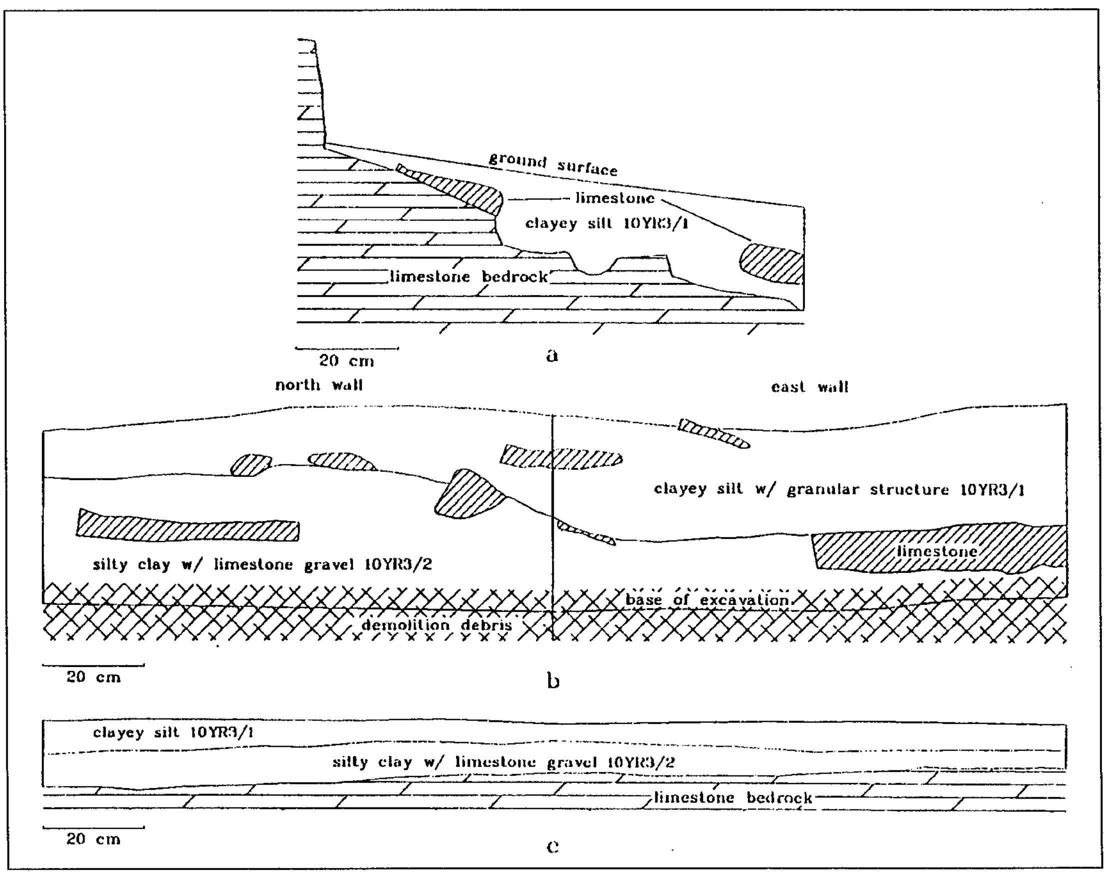

Figure 22. Profiles of Test Unit 1 (a) and Test Unit 2 (b), and Test Unit 3 (c), 14 RY 2118 (Larson and Penny 1998).

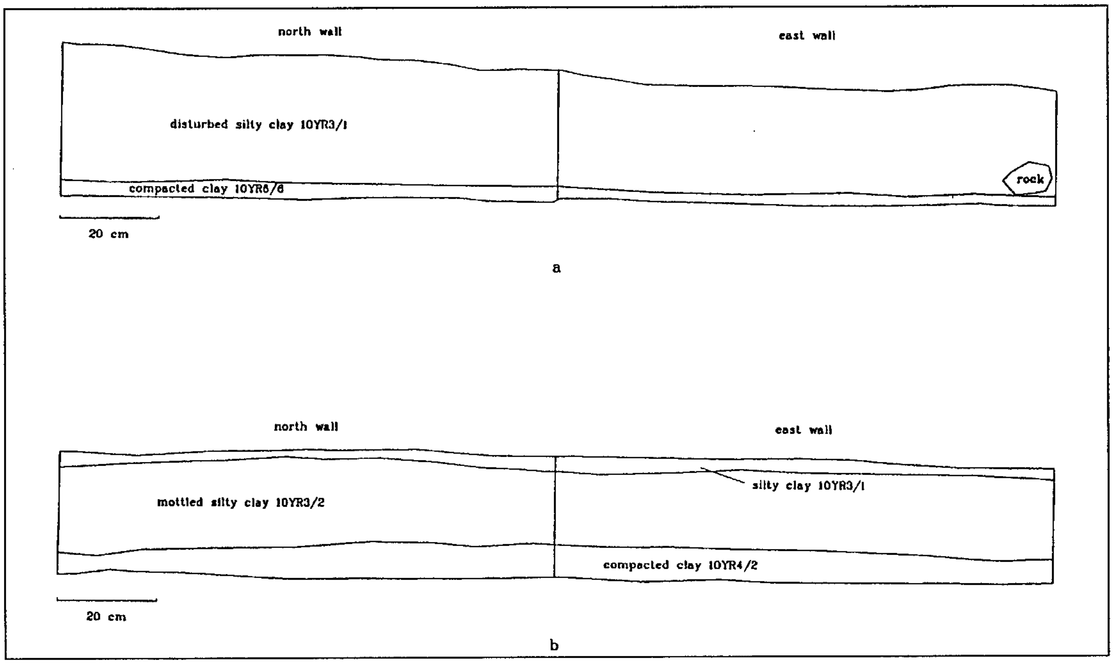

Figure 23. Profiles of Test Unit 1 (a) and Test Unit 2 (b), 14RY2170 (Larson and Penny 1998).

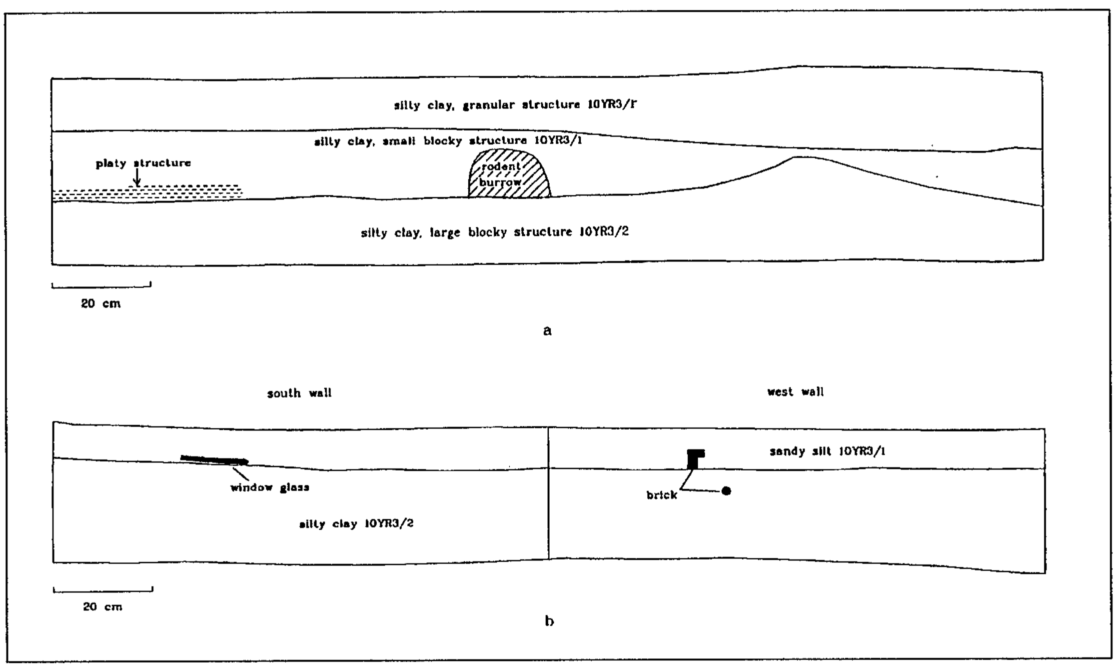

Figure 24. Profiles of Test Unit 1 (a) and Test Unit 2 (b), 14RY2171 (Larson and Penny 1998).

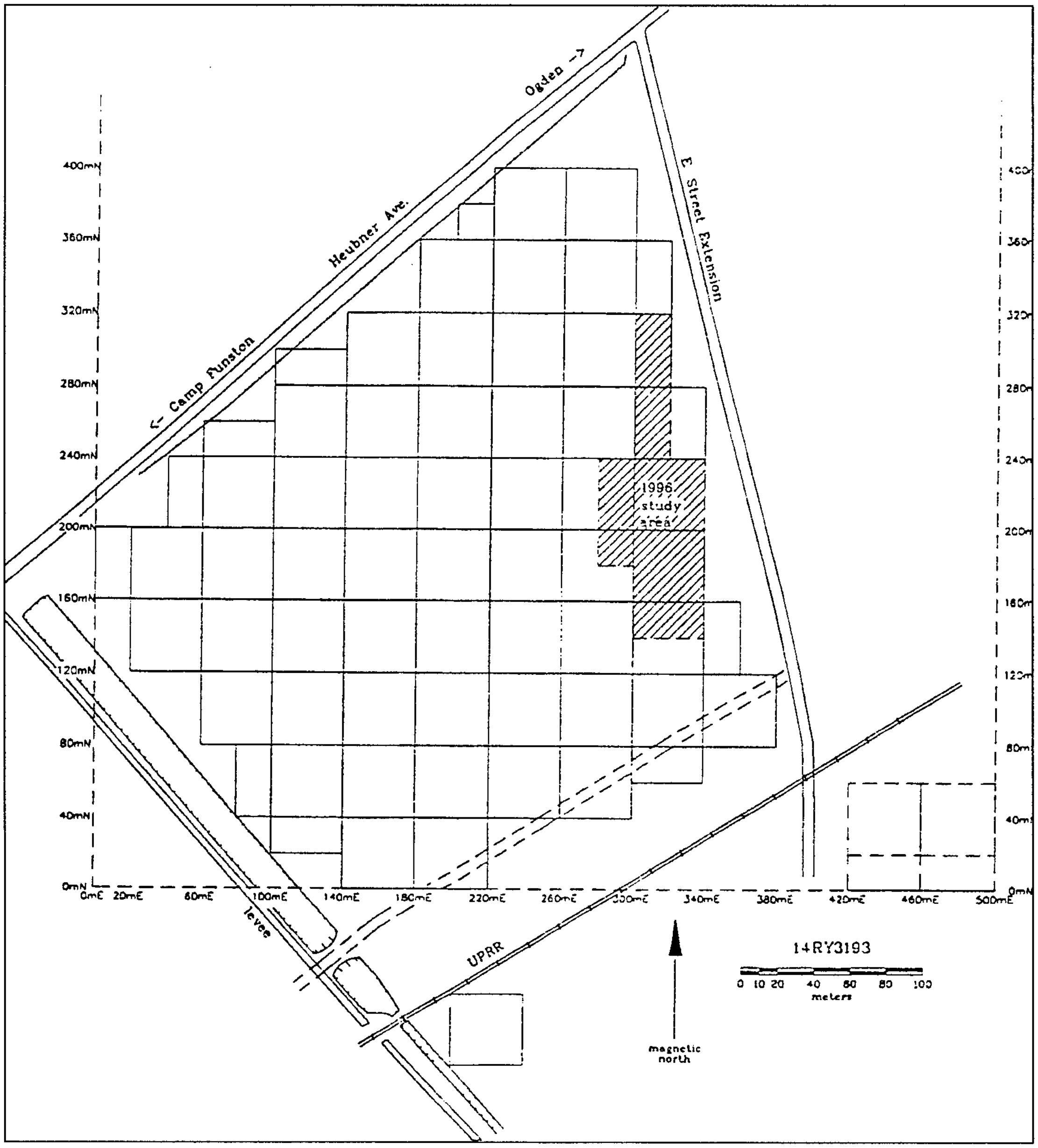

Figure 25. Map of Army City 14RY3193 showing the staked grid and the 1996 study area (Larson and Penny 1998).

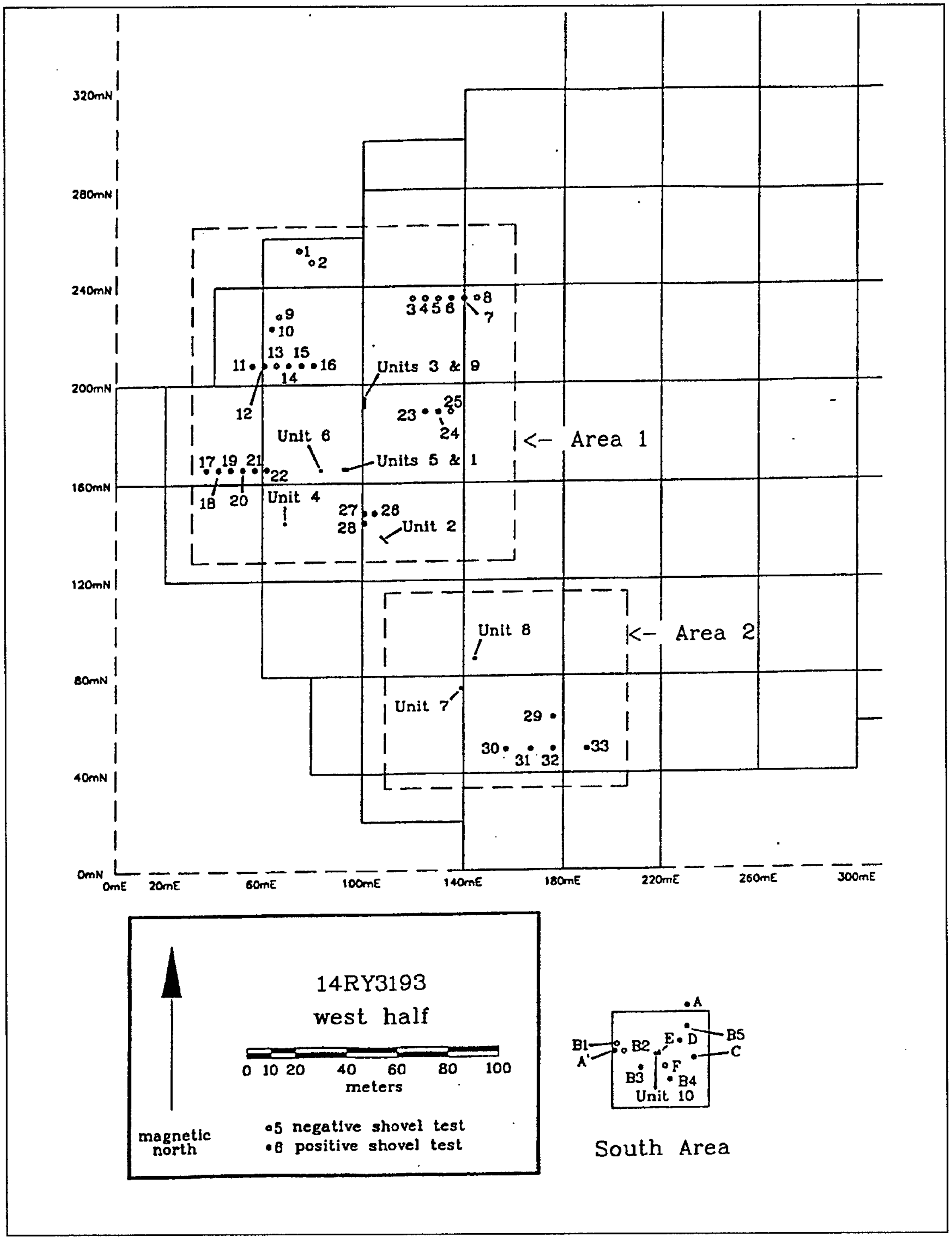

Figure 26. Locations of excavation units in the western part of Army City, 14RY3193 (Larson and Penny 1998).

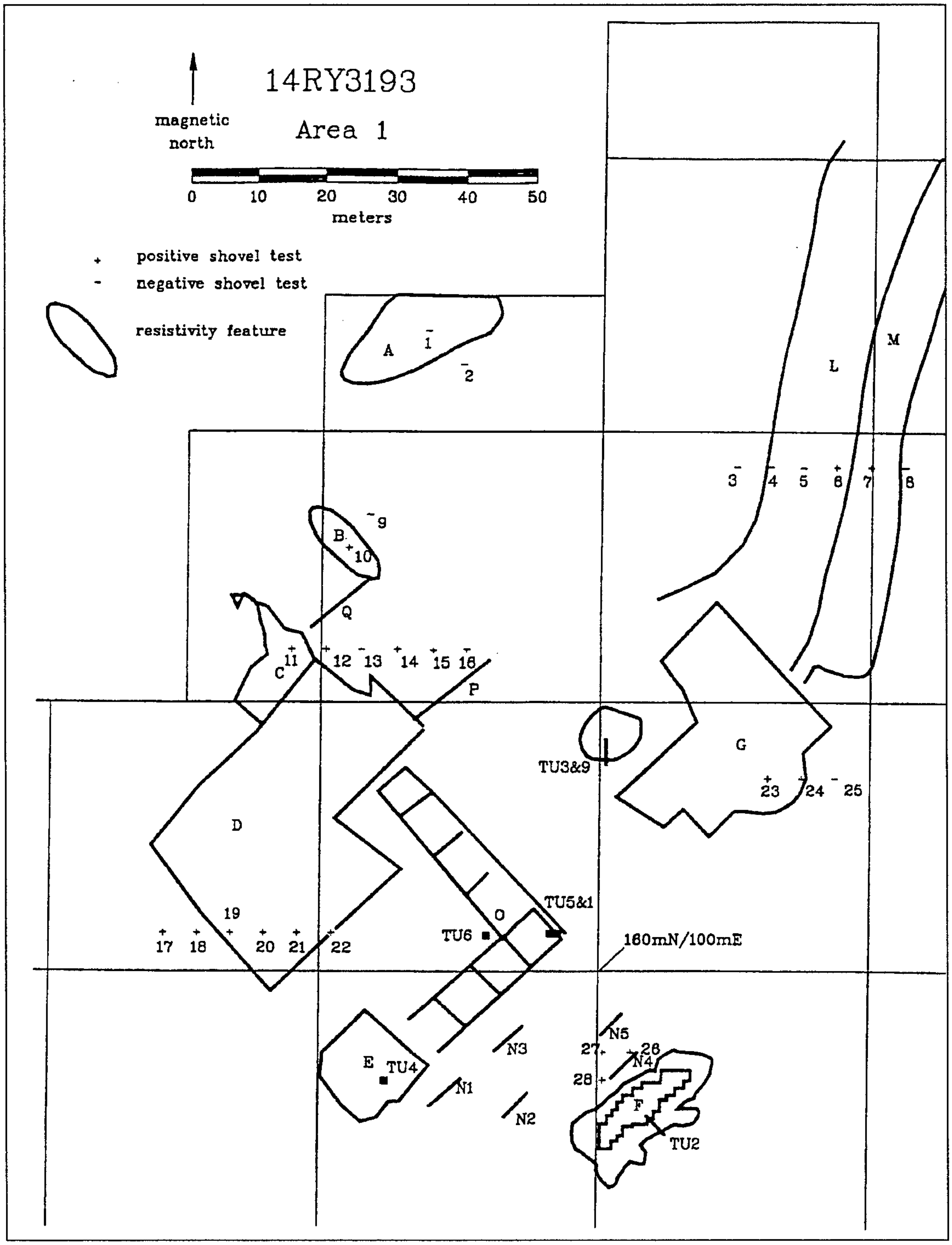

Figure 27. Locations of excavation units relative to resistivity features in Area 1, Army City 14RY3193 (Larson and Penny 1998).

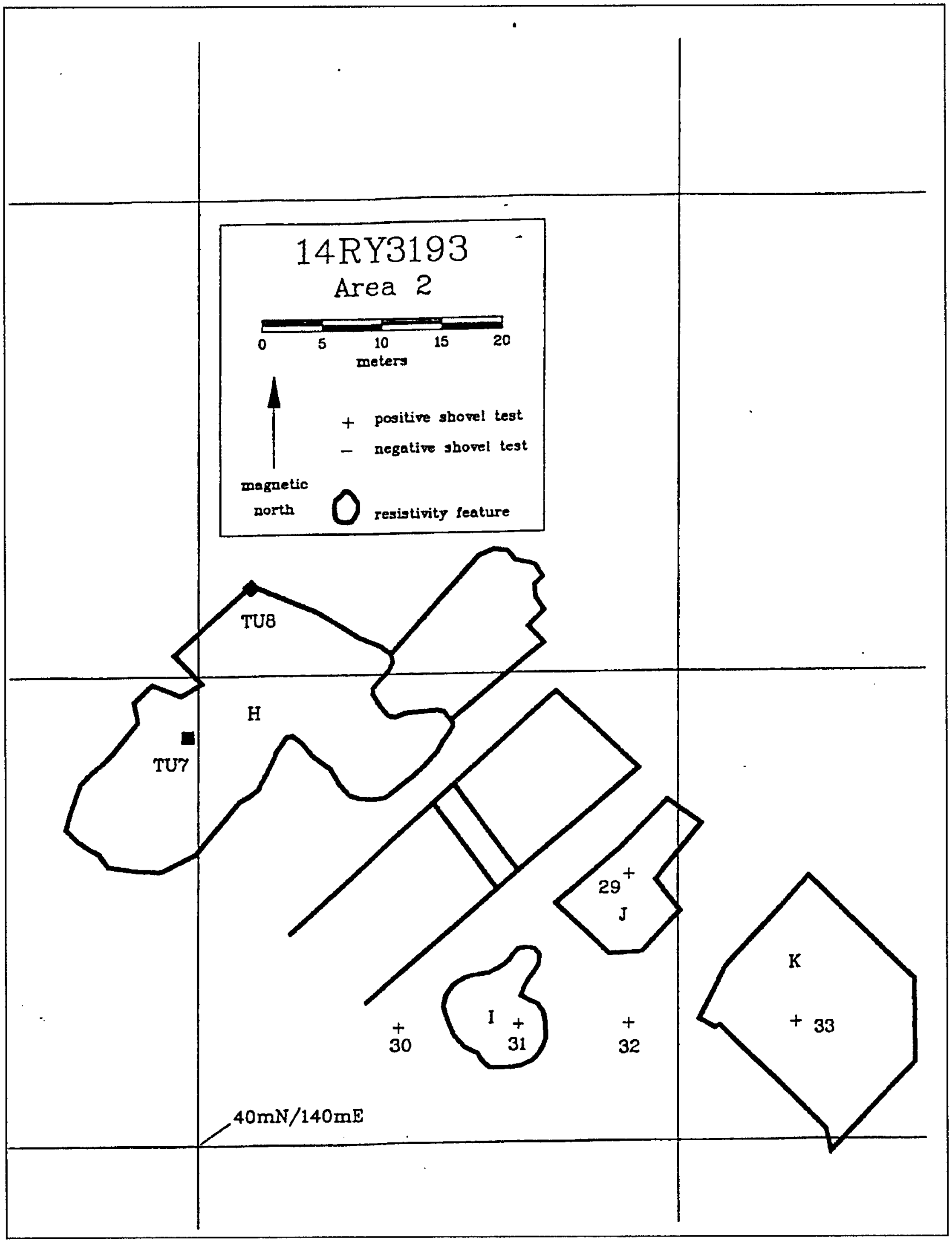

Figure 28. Locations of excavation units relative to resistivity features in Area 2, Army City Site 14RY3193 (Larson and Penny 1998).

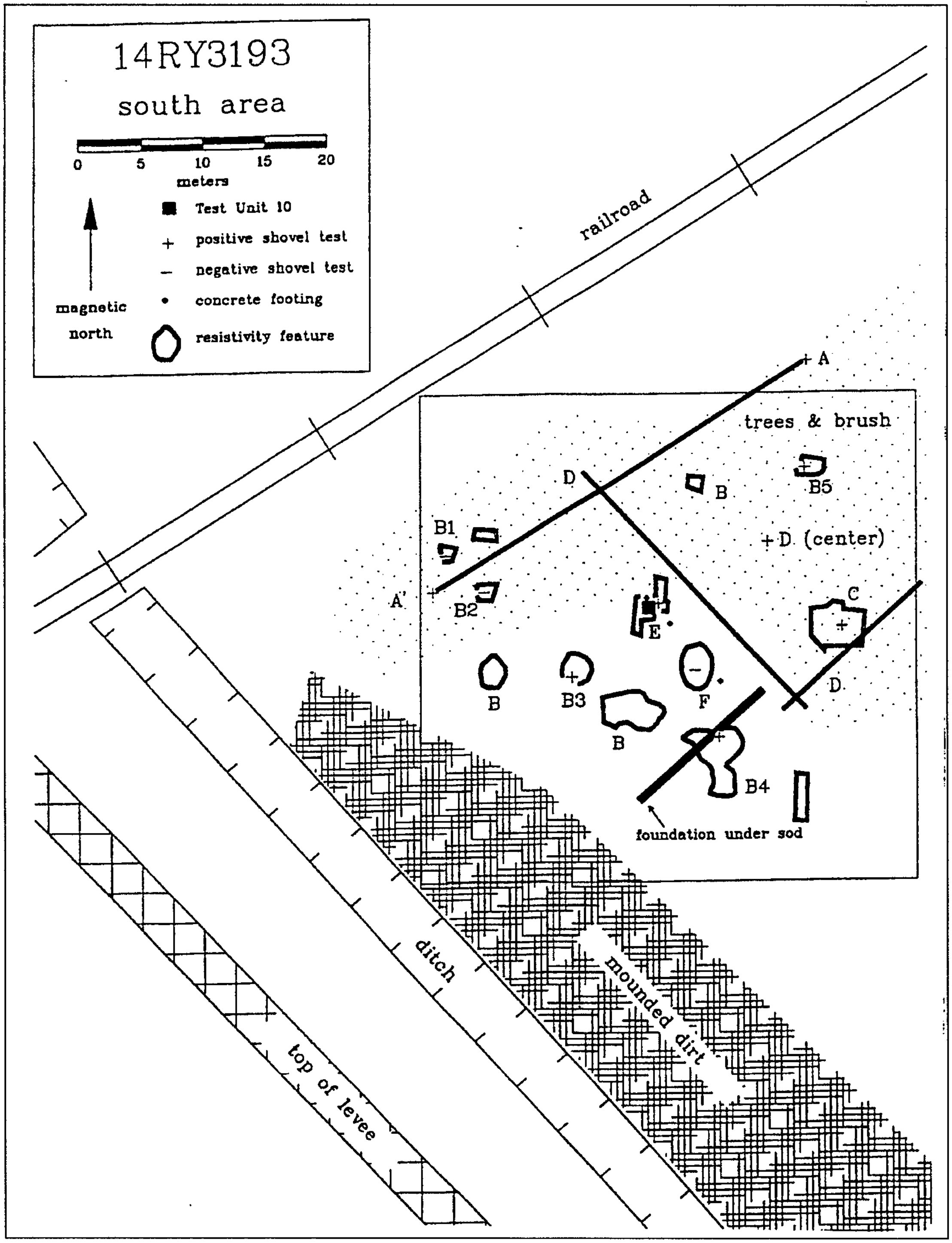

Figure 29. Locations of excavation units relative to resisitivity features in the south area, Army City Site 14RY3193 (Larson and Penny 1998).

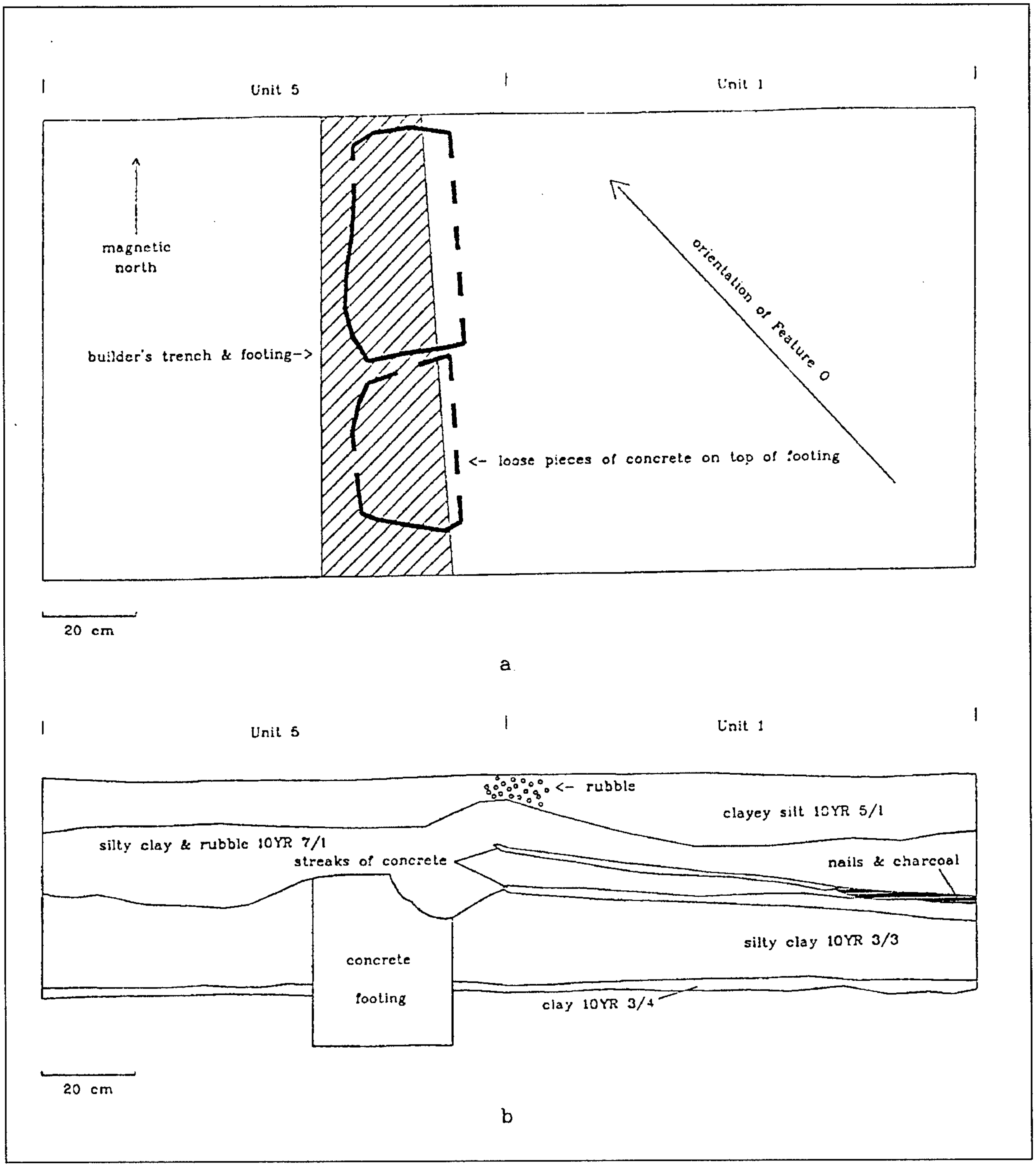

Figure 30. Floor plan (a) and mirror image (viewed from the south) profile (b) of the south wall of Test Units 1 and 5 (Larson and Penny 1998).

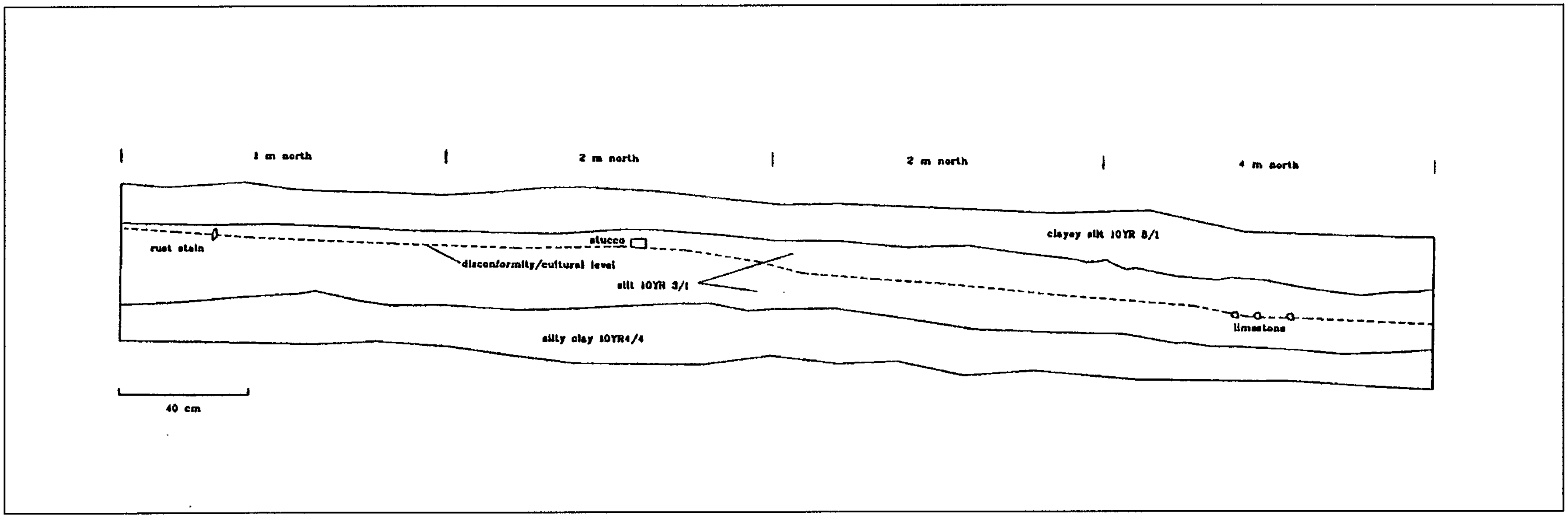

Figure 31. Profile of Test Unit 2 west wall, area 1, Army City Site 14RY3193 (Larson and Penny 1998).

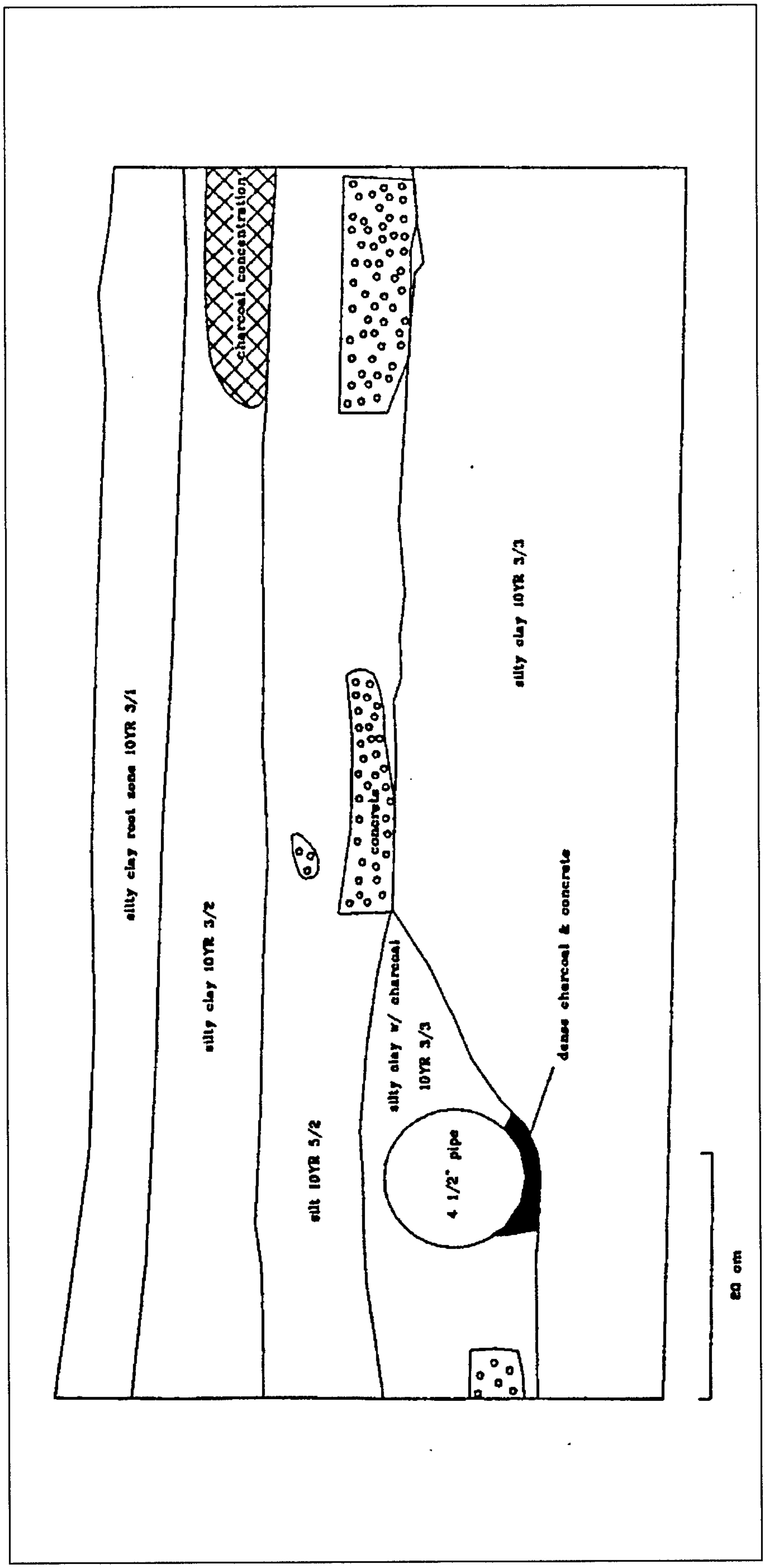

Figure 32. Profile of test Unit 6 east wall area 1, Army City Site 14RY3193 (Larson and Penny 1998).

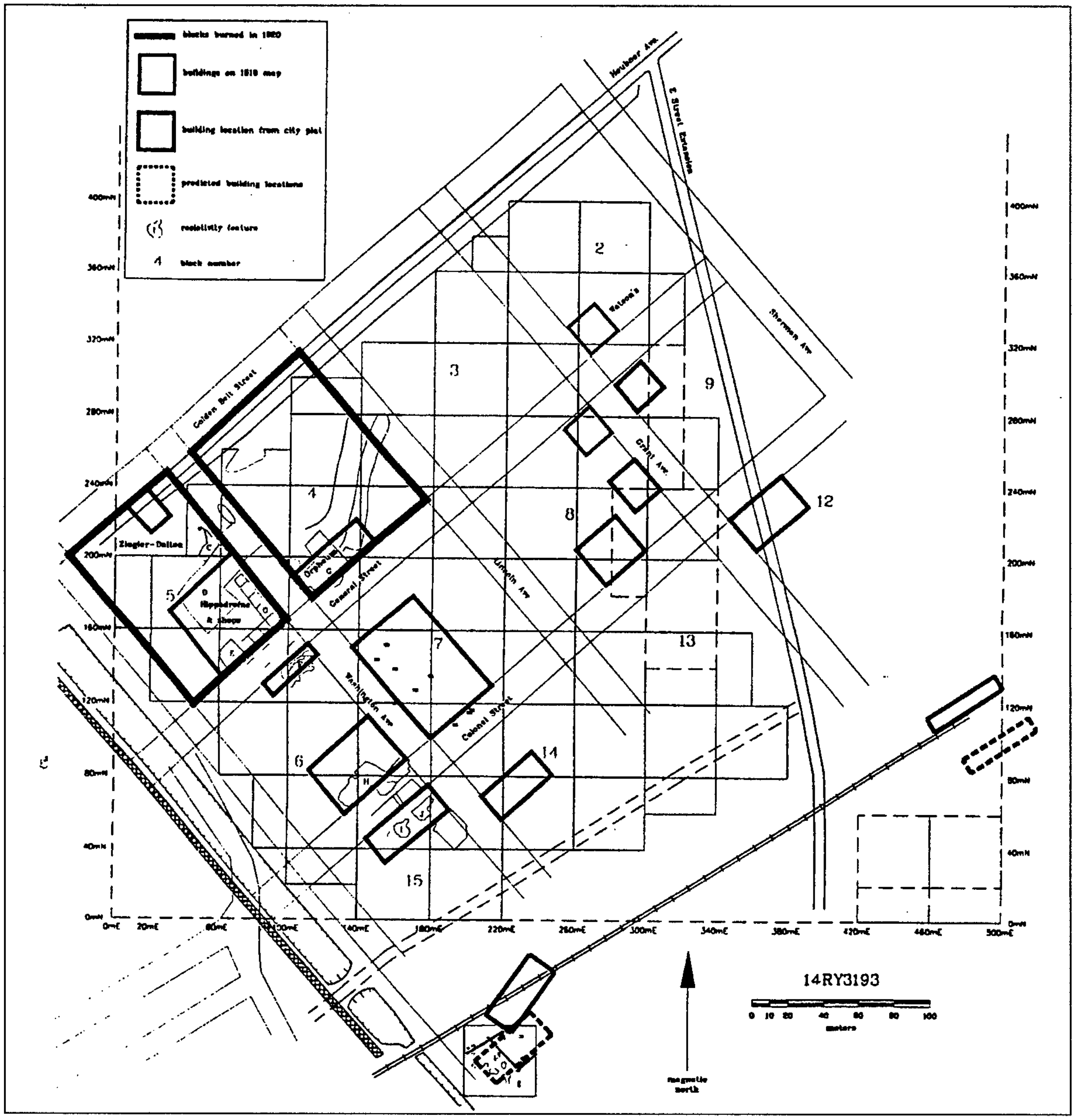

Figure 33. Map of Army City showing buildings from 1917 map relative to major resistivity features (Larson and Penny 1998).

Plates

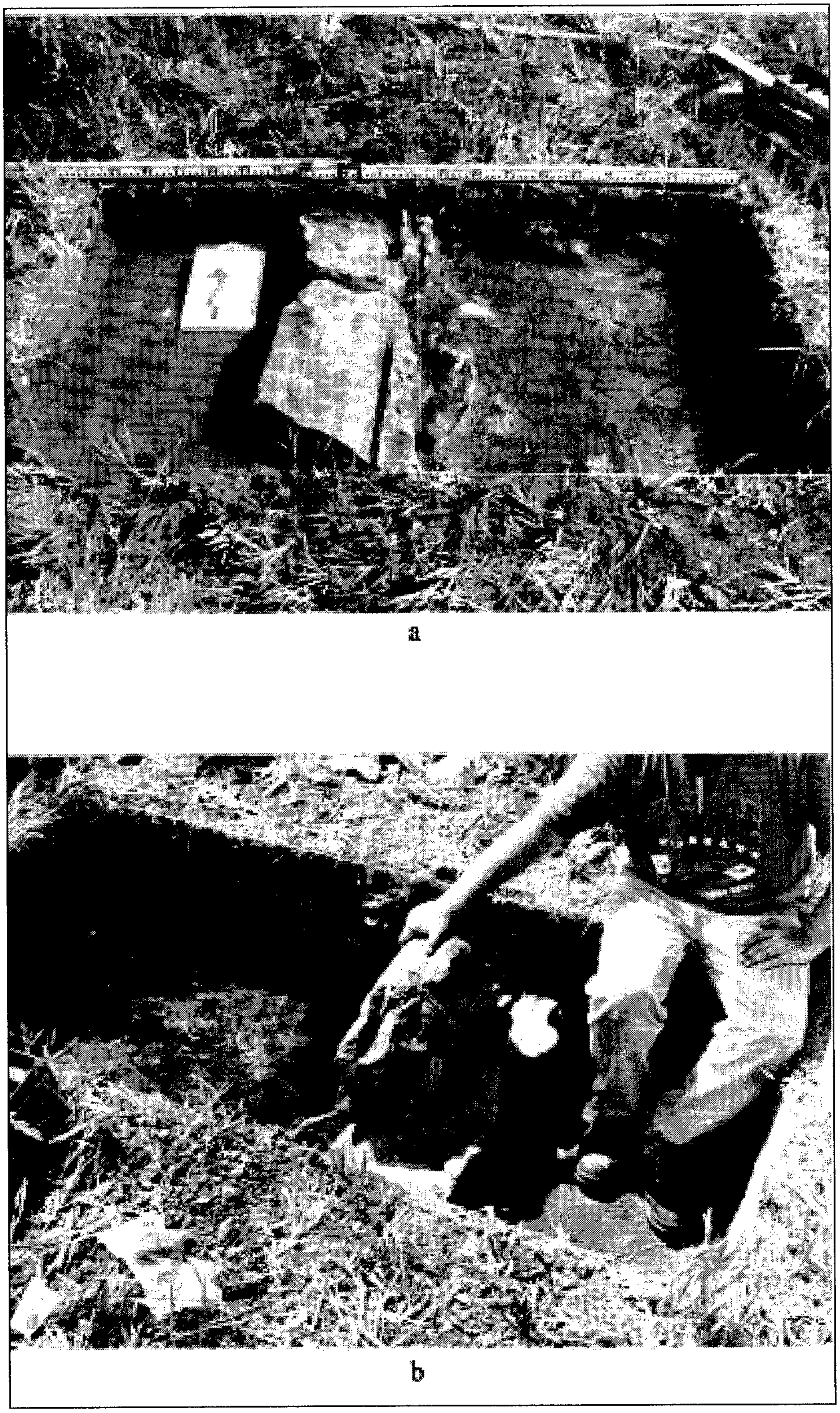

Plate 1. (a) concrete pieces in Test Units 1 and 5 and (b) a piece refitted to the footing.

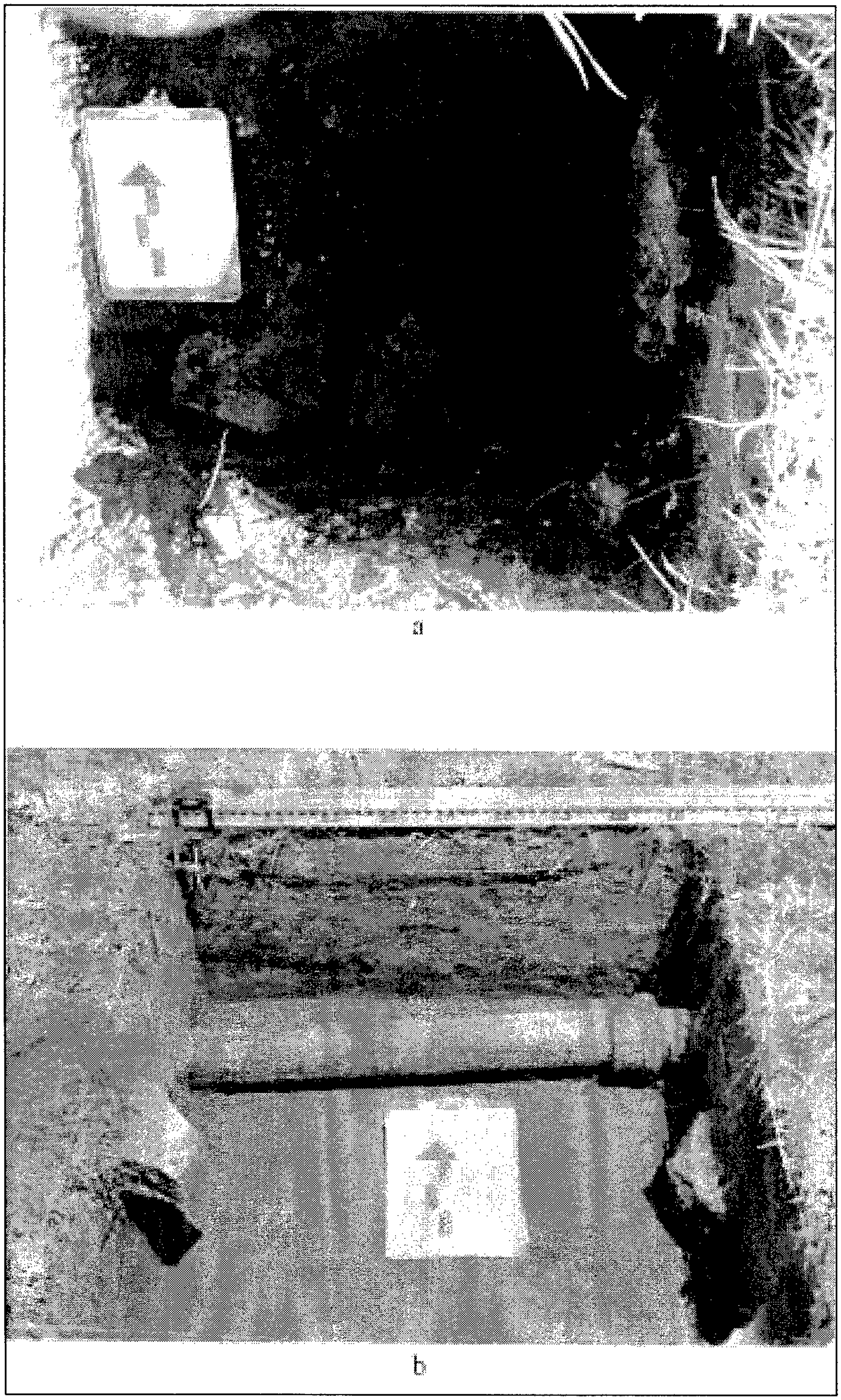

Plate 2. (a) the rubble within Test Unit 4 and (b) the sewer pipe in Test Unit 6.

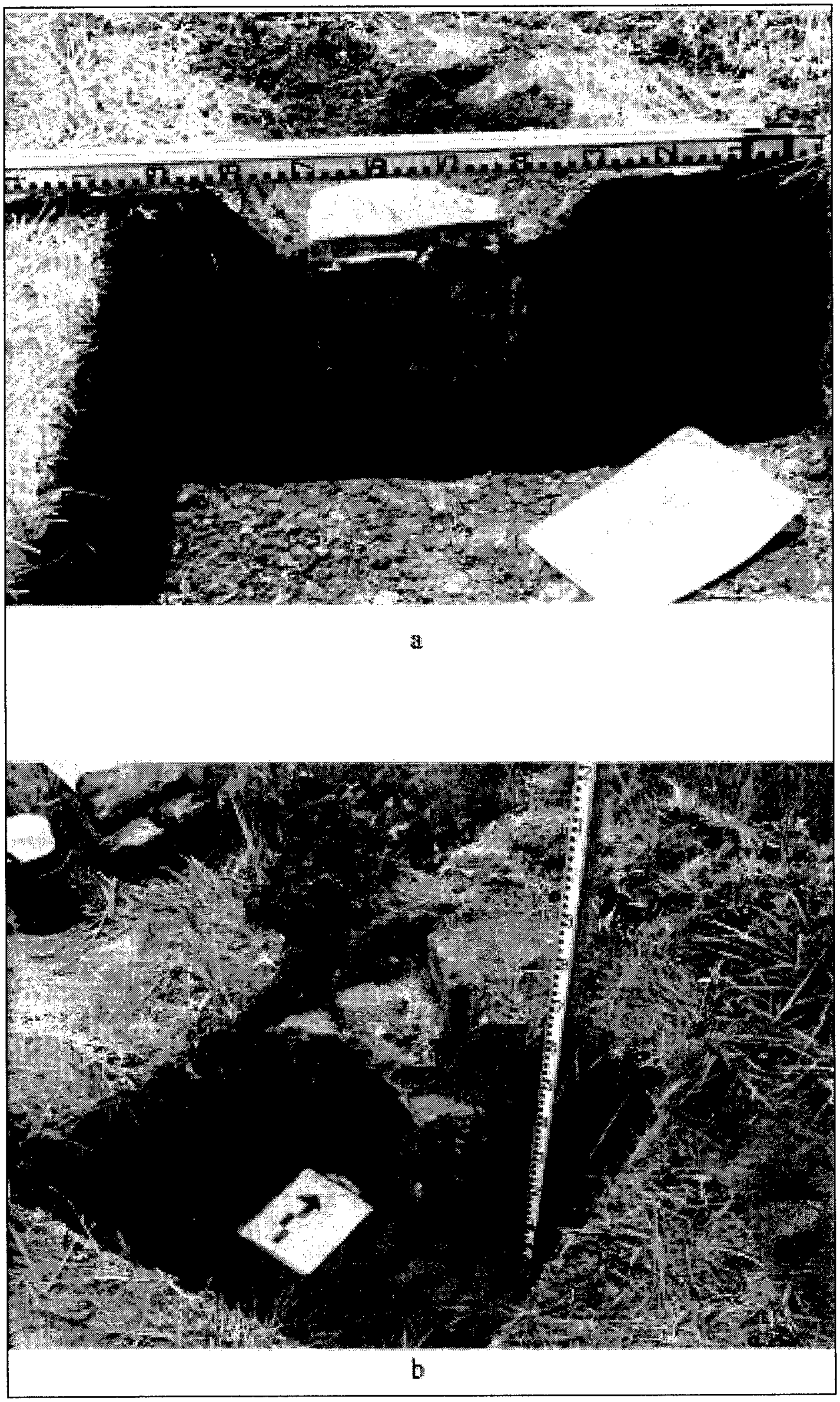

Plate 3. (a) the limestone block in the northwest wall of Test Unit 8 and (b) the concrete footing in the north wall of Test Unit 10.

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